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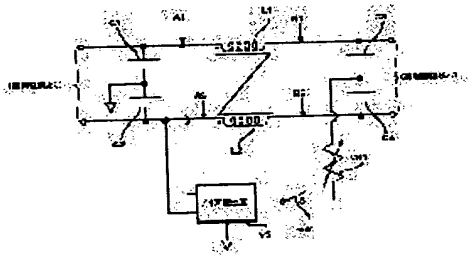
(54) APPARATUS AND METHOD FOR INJECTION OF NOISE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a noise injection apparatus or the like which is small and lightweight, and by which a noise can be injected safely into a power-supply line while a high voltage is not generated by itself.
SOLUTION: A noise generation source NS generates a noise. The noise is supplied, via a switch SW1, a variable resistor VR1, and capacitors C1, C2, to a pair of power-supply ends provided at an apparatus to be tested as an object for a noise test. The noise is cut off substantially by respective poles of a single-phase AC commercial power supply and by choke coils L1, L2 which are connected across the power-supply ends at the apparatus to be tested, and it is not supplied to the side of the commercial power supply. On the other hand, a voltage which is supplied by the commercial power supply is supplied, via the choke coils L1, L2, to the power-supply ends at the apparatus to be tested. As a result, according to the principle of superposition, the sum of a voltage of the noise supplied by the noise generation source NS and the voltage supplied by the commercial power supply is applied to the power-supply ends at the apparatus to be tested.



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CLAIMS

[Claim(s)]
[Claim 1] In the noise transfer pipet which supplies a noise to a testing-machine-ed machine equipped with one pair of current supply edges through each ********** Said one pair of noises which a noise generating means to generate one pair of noises of an inphase substantially, and said noise generating means generated It is the noise transfer pipet with which it has a power superposition means to superimpose on the power which an external power source supplies, and to supply said one pair of current supply edges, and said power superposition means is characterized by what it has a noise antisuckback means to prevent substantially that each aforementioned noise flows backwards toward the power source of said exterior for.
[Claim 2] Said noise antisuckback means is noise transfer pipet according to claim 1 characterized by what it has a means to prevent substantially that one pair of currents of an inphase pass substantially toward the power source of said exterior for.
[Claim 3] It is the noise transfer pipet according to claim 1 or 2 characterized by what the power source of said exterior is a single-phase alternative current power source, and each end is connected to each aforementioned current supply edge, and each other end is connected to each pole of said single-phase alternative current power source, and said noise antisuckback means passes the electrical signal of the frequency of said single-phase alternative current power source, and is equipped with one pair of inductors which intercept the electrical signal of the frequency of each aforementioned noise substantially for.
[Claim 4] Each of one pair of said inductors is noise transfer pipet according to claim 3 characterized by what it has for the inductive-coupling means which carries out mutual induction of the electromotive force of the sense which negates the electromotive force in which said inductor which makes each one and a pair according to the single-phase alternative current current supplied from said single-phase alternative current power source carries out a self-induction to the inductor concerned which makes each one and a pair.
[Claim 5] Said power superposition means is noise transfer pipet according to claim 3 or 4 characterized by what it has a mutual induction means to carry out induction of the electrical potential difference of each aforementioned noise to said one pair of inductors for.
[Claim 6] Said mutual induction means is noise transfer pipet according to claim 3, 4, or 5 characterized by what it has for the means to which the linkage of the magnetic flux to which said one pair of inductors carry out induction of the electrical potential difference of each aforementioned noise is carried out common to said one pair of inductors.
[Claim 7] Said power superposition means is noise transfer pipet according to claim 3 or 4 characterized by what it has a means to impress the electrical potential difference of each aforementioned noise to the track which connects said one pair of inductors, and said one pair of current supply edges for.
[Claim 8] Said power superposition means is noise transfer pipet according to claim 3, 4, or 5 characterized by what the track which connects said one pair of current supply edges with said one pair of inductors is equipped with the means which carries out induction of the current of each aforementioned noise for.
[Claim 9] Said noise generating means is noise transfer pipet according to claim 1 to 8 characterized by what it has a means to drive according to the power source of said exterior, and to generate one pair of noises of an inphase substantially for.
[Claim 10] Said noise generating means is noise transfer pipet according to claim 1 to 8 characterized by what it has a means to generate one pair of noises of opposition substantially mutually for.
[Claim 11] The power source of said exterior is a single-phase alternative current power source. Said noise antisuckback means Each end is connected to each aforementioned current supply edge, and each other end is connected to each pole of said single-phase alternative current power source. The electrical signal of the frequency of said single-phase alternative current power source is passed, and it has one pair of inductors which intercept the electrical signal of the frequency of each aforementioned noise substantially. Said noise

generating means The both ends of the inductor for noise generating a[redacted]uipped with the means which carries out induction of the electrical potential difference of one pair of said noises of opposition substantially mutually. Said power superposition means Noise transfer pipet according to claim 10 characterized by what it has a means to impress the electrical potential difference of said noise by which induction was carried out to each edge of the inductor for said noise generating to the track which connects said one pair of inductors, and said one pair of current supply edges for.
[Claim 12] Said noise generating means is noise transfer pipet according to claim 1 to 11 characterized by what it has a means to adjust the amount of each aforementioned noise supplied to said one pair of current supply edges for according to the actuation from the outside.
[Claim 13] The noise transfer pipet characterized by what it has for a noise antisuckback means prevent substantially that it is connected between a noise generating means generate a noise, and the current-supply edge with which an electrical machinery and apparatus is equipped and the pole with which an external power source is equipped, and supply the power supplied from the power source of said exterior to each aforementioned current-supply edge, superimpose said noise on said power, supply each aforementioned current-supply edge, and said noise is supplied to the power source of said exterior.
[Claim 14] In the noise impregnation approach which supplies a noise to a testing-machine-ed machine equipped with one pair of current supply edges through each ********** Said one pair of noises which the noise generating step which generates one pair of noises of an inphase substantially, and said noise generating step generated It has the power superposition step which superimposes on the power which an external power source supplies, and is supplied to said one pair of current supply edges. Said power superposition step The noise impregnation approach characterized by what it has for the noise antisuckback step which prevents substantially that each aforementioned noise flows backwards toward the power source of said exterior.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to noise transfer pipet and the noise impregnation approach.
[0002]
[Description of the Prior Art] In case a noise (noise) and the effect which especially common mode noise (namely, noise impressed to one pair of tracks [both] so that electric variates, such as a current and an electrical potential difference, may become in phase substantially) has on an electrical machinery and apparatus are investigated conventionally, generally, a noise is poured into the electrical machinery and apparatus (testing-machine-ed machine) of a test objective, and the technique of investigating actuation of a testing-machine-ed machine is taken.
[0003] When pouring a noise into power-source Rhine of a testing-machine-ed machine, the noise transfer pipet which generates and supplies the electrical potential difference equivalent to what superimposed the noise on the supply voltage which should be supplied to a testing-machine-ed machine supplies the power source to the testing-machine-ed machine conventionally.
[0004] When such noise transfer pipet pours in common mode noise, noise transfer pipet and a testing-machine-ed machine carry out touch-down potential in common. And phases differ about 180 degrees mutually, and the noise transfer pipet concerned generates two alternating voltage the average potential on the basis of touch-down potential has a relation equal to the instantaneous value of the common mode noise concerned, and is pouring in common mode noise by the technique supplied to a testing-machine-ed machine.
[0005]
[Problem(s) to be Solved by the Invention] However, when noise transfer pipet supplies the electrical potential difference equivalent to a source power supply by this technique, the alternating voltage which has the actual value of about 100 volts will be generated. In this case, since such noise transfer pipet generates the high voltage itself, its risk of causing the disaster by electrification, a spark, etc. is large in the case of actuation.
[0006] Moreover, since such noise transfer pipet generates the alternating voltage which has the actual value of about 100 volts, it is necessary to have component parts, such as a large-sized capacitor which has pressure-proofing of about hundreds of volts. For this reason, noise transfer pipet becomes on a large scale and heavy, and handling becomes difficult.
[0007] This invention was made in view of the above-mentioned actual condition, and it aims at offering the noise transfer pipet and the noise impregnation approach of performing noise impregnation to power-source Rhine safely, without generating the high voltage offering small lightweight noise transfer pipet and for oneself.
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the noise transfer pipet concerning the 1st viewpoint of this invention In the noise transfer pipet which supplies a noise to a testing-machine-ed machine equipped with one pair of current supply edges through each ********** Said one pair of noises which a noise generating means to generate one pair of noises of an inphase substantially, and said noise generating means generated It has a power superposition means to superimpose on the power which an external power source supplies, and to supply said one pair of current supply edges, and said power superposition means is characterized by what it has a noise antisuckback means to prevent substantially that each aforementioned noise flows backwards toward the power source of said exterior for.
[0009] Such noise transfer pipet pours common mode noise to power-source Rhine into insurance, without

generating supply voltage oneself, since each aforementioned noise is superimposed on said power supplied from an external power source. Moreover, since such noise transfer pipet does not generate supply voltage itself, even if the supply voltage is a high voltage, it does not need to be equipped with a component part large-sized [the capacitor of high pressure-proofing etc.], and heavy. For this reason, such noise transfer pipet becomes lightweight small.

[0010] It is prevented that a thing equipped with a means to prevent substantially that one pair of currents of an inphase pass said noise antisuckback means substantially toward the power source of said exterior, then common mode noise flow into the power source of said exterior. For this reason, it is avoided that said common mode noise flows into other electrical machinery and apparatus which the efficiency of impregnation of common mode noise is increased, and are connected to the power source of said exterior in common through the power source of said exterior.

[0011] The power source of said exterior is for example, a single-phase alternative current power source, and in that case, each end is connected to each aforementioned current supply edge, and each other end may be connected to each pole of said single-phase alternative current power source, and said noise antisuckback means may pass the electrical signal of the frequency of said single-phase alternative current power source, and may be equipped with one pair of inductors which intercept the electrical signal of the frequency of each aforementioned noise substantially, for example.

[0012] It is prevented that the noise in a thing equipped with the inductive-coupling means which carries out mutual induction of the electromotive force of the sense which negates the electromotive force with which said inductor which makes each one and a pair according to the single-phase alternative current current supplied from said single-phase alternative current power source carries out the self-induction of each of one pair of said inductors to the inductor concerned which makes each one and a pair, then the common mode supplied from said single-phase alternative current power source is supplied to said electrical machinery and apparatus. Moreover, the situation where the electrical potential difference which said single-phase alternative current power source supplies with the electromotive force in which said one pair of inductors carry out a self-induction according to the single-phase alternative current current supplied from said single-phase alternative current power source is offset is also prevented, and supply of a power source becomes efficient.

[0013] Said power superposition means may be equipped with a mutual induction means to carry out induction of the electrical potential difference of each aforementioned noise to said one pair of inductors. Thereby, since said one pair of inductor itself generates a noise, it is simplified and the configuration of this noise transfer pipet comes to be constituted by the small light weight. Moreover, since the impedance of the track to which the power source and said testing-machine-ed machine of said exterior are connected is stopped low, supply of a power source is performed efficiently.

[0014] Said mutual induction means makes said one pair of inductor itself generate a noise by having the means to which the linkage of the magnetic flux to which said one pair of inductors carry out induction of the electrical potential difference of each aforementioned noise is carried out common to said one pair of inductors, for example.

[0015] Said power superposition means on for example, the track which connects said one pair of inductors, and said one pair of current supply edges By having a means to impress the electrical potential difference of each aforementioned noise, may pour said noise into said electrical machinery and apparatus, and moreover, said power superposition means For example, said noise may be poured into said electrical machinery and apparatus by equipping the track which connects said one pair of current supply edges with said one pair of inductors with the means which carries out induction of the current of each aforementioned noise.

[0016] Since a thing equipped with a means to drive said noise generating means according to the power source of said exterior, and to generate one pair of noises of an inphase substantially, then said noise transfer pipet supply said noise to said electrical machinery and apparatus, without equipping oneself with a means to supply a power source, they become lightweight small [said noise transfer pipet].

[0017] The thing which said noise generating means equips with a means to generate one pair of noises of opposition substantially mutually, then said noise transfer pipet pour the noise of normal mode into said electrical machinery and apparatus, without requiring having said electrical machinery and apparatus and a common ground.

[0018] If the power source of said exterior is for example, a single-phase alternative current power source, for example in this case, said noise antisuckback means Each end is connected to each aforementioned current supply edge, and each other end is connected to each pole of said single-phase alternative current power source. The electrical signal of the frequency of said single-phase alternative current power source is

passed, and it has one pair of inductors which intercept the electrical signal of the frequency of each aforementioned noise substantially. Said noise generating means The both ends of the inductor for noise generating are equipped with the means which carries out induction of the electrical potential difference of one pair of said noises of opposition substantially mutually. Said power superposition means By having a means to impress the electrical potential difference of said noise by which induction was carried out to each edge of the inductor for said noise generating to the track which connects said one pair of inductors, and said one pair of current supply edges Said noise transfer pipet pours the noise of said normal mode into said electrical machinery and apparatus.

[0019] Said noise of a thing equipped with a means to adjust the amount of each aforementioned noise which supplies said noise generating means to said one pair of current supply edges according to the actuation from the outside, then the amount according to actuation of an operator is poured into said electrical machinery and apparatus.

[0020] Moreover, the noise transfer pipet concerning the 2nd viewpoint of this invention It connects between a noise generating means to generate a noise, and the current supply edge with which an electrical machinery and apparatus is equipped and the pole with which an external power source is equipped. It is characterized by what it has a noise antisuckback means to prevent substantially that supply the power supplied from the power source of said exterior to each aforementioned current supply edge, superimpose said noise on said power, supply each aforementioned current supply edge, and said noise is supplied to the power source of said exterior for.

[0021] Such noise transfer pipet pours the noise to power-source Rhine into insurance, without generating supply voltage oneself, since said noise is superimposed on said power supplied from an external power source. Moreover, since such noise transfer pipet does not generate supply voltage itself, either, even if the supply voltage is a high voltage, it is not necessary to have a component part large-sized [the capacitor of high pressure-proofing etc.], and heavy. For this reason, such noise transfer pipet becomes lightweight small.

[0022] Moreover, the noise impregnation approach concerning the 3rd viewpoint of this invention In the noise impregnation approach which supplies a noise to a testing-machine-ed machine equipped with one pair of current supply edges through each ********** Said one pair of noises which the noise generating step which generates one pair of noises of an inphase substantially, and said noise generating step generated It has the power superposition step which superimposes on the power which an external power source supplies, and is supplied to said one pair of current supply edges, and said power superposition step is characterized by what it has for the noise antisuckback step which prevents substantially that each aforementioned noise flows backwards toward the power source of said exterior.

[0023] Since said power supplied from an external power source is overlapped on each aforementioned noise according to such a noise impregnation approach, impregnation of the common mode noise to power-source Rhine is carried out to insurance, without requiring the step which generates supply voltage itself.

[0024]

[Embodiment of the Invention] The noise transfer pipet for pouring a noise into the testing-machine-ed machine which uses the source power supply of a single-phase alternative current for the noise transfer pipet and the noise impregnation approach concerning the gestalt of implementation of this invention hereafter is explained as an example.

[0025] (Gestalt of the 1st operation) Drawing 1 shows the configuration of the noise transfer pipet concerning the gestalt of implementation of the 1st of this invention. This noise transfer pipet consists of choke coils L1 and L2, capacitors C1-C4, a noise generation source NS, and a variable resistor VR 1 and a switch SW1 so that it may illustrate.

[0026] While choke coils L1 and L2 remove the harmonic content contained in a source power supply, it is for the noise which the noise generation source NS generates to prevent passing through the track between the point A1-points B1 shown in drawing 1 , and between point A2-point B-2s.

[0027] One pair of poles of a source power supply are connected to 1 to 1, and each other end of choke coils L1 and L2 is connected to each end of choke coils L1 and L2 1 to 1 at the power-source input edge with which the testing-machine-ed machine which is the object of a noise trial is equipped.

[0028] The value of the inductance of choke coils L1 and L2 is a big value to extent which prevents passage of the electrical signal with which choke coils L1 and L2 belong to the frequency band of the noise which the noise generation source NS generates. However, the value of the inductance of choke coils L1 and L2 is a value small to extent passed without choke coils' L1 and L2 seeing substantially the electrical signal belonging to the frequency band of a source power supply, and producing loss.

[0029] Moreover, each edge of the direction which choke coils L1 and [redacted] consist of a coil wound around the same core at bifilar, for example, and is connected to each pole of a source power supply of choke coils L1 and L2 is an edge by the side of the cut water of this coil, or this coil rolls all and it is an edge by the side of an end.
[0030] If the current (namely, current of normal mode) of opposition is mutually supplied substantially from the two poles of a source power supply, choke coils L1 and L2 will carry out induction of the electromotive force of the sense which negates back EMF in which each carries out a self-induction according to the current which flows to each mutually by mutual induction.
[0031] For example, back EMF of the sense which passes a current at the end of the side connected to it at the testing-machine-ed machine from the edge of the side connected to the source power supply by the self-induction at the choke coil L1 when the current which flows at the end of the side connected to the source power supply from the edge of the side connected to the testing-machine-ed machine flowed to the choke coil L1 occurs. A current flows at the end of the side connected to the choke coil L1 on the other hand at the testing-machine-ed machine from the edge of the side connected to the source power supply at the choke coil L2 while the current which flows at the end of the side connected to the source power supply from the edge of the side connected to the testing-machine-ed machine flowed. And this current carries out induction of the electromotive force of the sense which passes a current at the end of the side connected to the choke coil L1 from the edge of the side connected to that testing-machine-ed machine at the source power supply by mutual induction.
[0032] Consequently, back EMF which the choke coil L1 generated by the self-induction, and the electromotive force to which the flowing current carried out induction of the choke coil L2 to the choke coil L1 by mutual induction negate each other mutually. Moreover, back EMF which the choke coil L2 generated by the self-induction, and the electromotive force to which the flowing current carried out induction of the choke coil L1 to the choke coil L2 by mutual induction negate each other mutually similarly.
[0033] For this reason, the electrical potential difference of the normal mode impressed from the two poles of a source power supply in order to supply the current of normal mode is supplied to a testing-machine-ed machine, without generating a voltage drop substantially. And choke coils L1 and L2 may have the big reactance in extent which makes the both ends generate a voltage drop substantially, when the signal belonging to the band of a source power supply is passed independently respectively.
[0034] On the other hand, when the current (namely, current in the common mode) of an inphase is mutually supplied to the edge of the side connected to the testing-machine-ed machine of choke coils L1 and L2 substantially, back EMF to which each carries out the self-induction of the choke coils L1 and L2 according to the current in the flowing common mode concerned is not negated depending on the electromotive force generated by mutual induction.
[0035] For example, it becomes the sense with same back EMF which the choke coil L1 generated by the self-induction and electromotive force to which the flowing current carried out induction of the choke coil L2 to the choke coil L1 by mutual induction. Moreover, back EMF which the choke coil L2 generated by the self-induction, and the electromotive force to which the flowing current carried out induction of the choke coil L1 to the choke coil L2 by mutual induction serve as the same sense similarly.
[0036] For this reason, when common mode noise is supplied to the edge of the side connected to the testing-machine-ed machine of choke coils L1 and L2, as for the common mode noise concerned, an inflow to each pole of a source power supply is prevented by back EMF in which each carries out a self-induction according to the current which flows choke coils L1 and L2, and the electromotive force generated by mutual induction.
[0037] Capacitors C1 and C2 are for generating ground potential based on the potential of the two poles of a source power supply. Capacitors C1 and C2 are connected to a cascade, and both node is grounded. The edge of the side which the edge of the side which is not connected to the capacitor C2 among each edge of a capacitor C1 is connected at the node of a source power supply and a choke coil L1, and is not connected to the capacitor C1 among each edge of a capacitor C2 is connected at the node of a source power supply and a choke coil L2. The electrostatic capacity of capacitors C1 and C2 is substantially equal mutually, and, for this reason, the value of the potential of the node of capacitors C1 and C2 is substantially equal to what carried out the arithmetic mean of the value of the potential of the two poles of a source power supply.
[0038] Capacitors C3 and C4 are for pouring into a testing-machine-ed machine the noise which the noise generation source NS generated. Capacitors C3 and C4 are connected to a cascade, and both node is connected to the end of a variable resistor VR 1. The edge of the side which the edge of the side which is not

connected to the capacitor C4 among each edge of a capacitor C3 is connected at the node of a testing-machine-ed machine and a choke coil L1, and is not connected to the capacitor C3 among each edge of a capacitor C4 is connected at the node of a testing-machine-ed machine and a choke coil L2.

[0039] The noise generation source NS is equipped with the oscillator which consists of a blocking oscillator circuit etc., and generates the noise for pouring into a testing-machine-ed machine. The noise generation source NS is equipped with one pair of power-source input edges for acquiring the power source which drives the oscillator with which oneself is equipped, the outgoing end which outputs the alternating voltage used as a noise, and the touch-down edge which is not illustrated. Each power-source input edge is connected to 1 to 1 on each pole of a source power supply, an outgoing end is connected to the end of a switch SW1, and a touch-down edge is grounded.

[0040] If a source power supply is supplied to each power-source input edge, the noise generation source NS will rectify with the diodes D1-D4 by which bridge connection was carried out, after transforming the source power supply with Transformer PT, as shown, for example in drawing 2 , and will generate the direct current voltage for driving an oscillator. The oscillator driven with this direct current voltage generates an equal signal as a noise substantially [the value of the potential of a dc component] in the value of the arithmetic mean of the potential of the two poles of a source power supply including a frequency component higher than the frequency of a source power supply, and the noise concerned is impressed to the end of a switch SW1.

[0041] And the ground potential of a testing-machine-ed machine is substantially kept the same with the potential (namely, potential of a node with capacitors C1 and C2) of the noise generation source NS by connecting to the touch-down edge of the noise generation source NS the touch-down edge with which for example, a testing-machine-ed machine is equipped. Thereby, it is avoided that in one direction flowed fluctuation of the potential of each pole of a source power supply is impressed to a testing-machine-ed machine as a common mode noise.

[0042] A variable resistor VR 1 is for adjusting the amount of the noise poured into a testing-machine-ed machine. The end of a variable resistor VR 1 is connected to capacitors C3 and C4 as above-mentioned, and the other end is connected to the edge of the side which is not connected to the noise generation source NS among the both ends of a switch SW1.

[0043] A noise is outputted from the outgoing end of the noise generation source NS, and is supplied to a testing-machine-ed machine through a variable resistor VR 1 and capacitors C3 and C4.

[0044] The reactance of the choke coils L1 and L2 in the band of a noise is large enough, and intercepts the signal belonging to the band of a noise substantially. Moreover, back EMF in which the choke coils L1 and L2 to which the noise was supplied carry out a self-induction, and the electromotive force in which the choke coils L1 and L2 to which the noise was supplied carry out induction mutually by mutual induction prevent that a noise passes choke coils L1 and L2. For this reason, the noise which the noise generation source NS generates is supplied to a testing-machine-ed machine, without carrying out splitting to each pole of a source power supply substantially through a variable resistor VR 1 and capacitors C3 and C4.

[0045] When the current of the normal mode supplied from a source power supply, on the other hand, flows choke coils L1 and L2, back EMF by the self-induction occurs in choke coils L1 and L2. However, these back EMF is reduced by the electromotive force in which choke coils L1 and L2 carry out induction mutually by mutual induction. For this reason, the electrical potential difference supplied from a source power supply is supplied to the power-source input edge of a testing-machine-ed machine, without generating a voltage drop substantially in choke coils L1 and L2.

[0046] Therefore, the electrical potential difference which has an equal value substantially is impressed to the sum of the electrical potential difference supplied to each power-source input edge of a testing-machine-ed machine through a variable resistor VR 1 and capacitors C3 and C4 according to ** of superposition from the noise generation source NS, and the electrical potential difference of a source power supply. And the component of a noise is substantially in phase mutually among the electrical potential differences impressed to each power-source input edge of a testing-machine-ed machine. That is, the noise in the common mode is impressed to the power-source input edge of a testing-machine-ed machine.

[0047] A testing-machine-ed machine acquires the power containing the noise supplied from this noise transfer pipet as a power source, and drives it. And various kinds of noise trials are performed by examining the operating state by the noise supplied from noise transfer pipet.

[0048] Specifically, actuation of the testing-machine-ed machine at the time of using noise transfer pipet as a power source is compared with actuation of the testing-machine-ed machine at the time of using the power source which does not contain a noise. Moreover, when it is the testing-machine-ed machine which outputs

an electrical signal at the time of a drive, the common-mode-voltage rejection ratio (namely, ratio of the amplitude of the poured-in noise and the amplitude of the noise component contained in the electrical signal concerned) of the electrical signal outputted is measured.

[0049] In addition, the configuration of this noise transfer pipet is not restricted to an above-mentioned thing. For example, the injection rate of a noise does not need to be adjusted by the variable resistor VR 1, and the injection rate of a noise may be fixed.

[0050] Moreover, it is not necessary to drive the oscillator of the noise generation source NS with the electrical potential difference which transforms and rectifies and can obtain a source power supply for example, and it may be driven according to the power source of the exteriors, such as a cell. In this case, it is not necessary to connect with the two poles of a source power supply and, and Transformer PT and the diodes D1-D4 of the noise generation source NS are unnecessary.

[0051] Moreover, this noise transfer pipet may be equipped with the attenuator as replaced with a variable resistor VR 1, for example, shown in drawing 3 . This attenuator is equipped with two or more stages where each consists of three resistors connected to "T" character type so that it may illustrate. The resistor of each other except one piece by which the end is connected to the touch-down edge among the resistors which form each stage is connected to the cascade. One edge of the series circuit which the resistor connected to the cascade forms is connected to the outgoing end of the noise generation source NS through a switch SW1, and an other end is connected at the node of capacitors C3 and C4. And the touch-down edge is connected to the touch-down edge of the noise generation source NS.

[0052] Moreover, this attenuator is equipped with two or more double-pole and double-throw switches for separating each stage from this attenuator electrically according to actuation of an operator, and bypassing each separated stage electrically. And irrespective of whether the resistor of each stage is electrically separated from this attenuator, the resistance of each resistor which forms this attenuator is chosen so that the impedance of this attenuator seen from the node of capacitors C3 and C4 may serve as a fixed value substantially.

[0053] In the noise transfer pipet equipped with such an attenuator, the output impedance of a noise is seen from the current supply edge of a testing-machine-ed machine, and it is substantially fixed irrespective of the injection rate of a noise. For this reason, the amount of the noise poured into a testing-machine-ed machine is correctly controllable.

[0054] Moreover, in addition to the same capacitors C1-C4, the noise generation source NS, the variable resistor VR 1, and the switch SW1, this noise transfer pipet may be substantially equipped with a switch SW2 and choke coils L3 and L4 with the thing in the noise transfer pipet of drawing 1 , in order to supply a normal mode noise (namely, noise impressed to one side of one pair of tracks), for example, as shown in drawing 4 .

[0055] The switch SW2 is switchable so that the edge of the direction which consists of switches of a bipolar single throw and is not connected to the testing-machine-ed machine among capacitors C3 may be connected to either a variable resistor VR 1 and a ground. A choke coil L3 is connected between the node of a testing-machine-ed machine and a capacitor C3, and the node of a source power supply and a capacitor C1. A choke coil L4 is connected between the node of a testing-machine-ed machine and a capacitor C4, and the node of a source power supply and a capacitor C2.

[0056] The reactance in the band of a noise of choke coils L3 and L4 is large enough, and intercepts the signal belonging to the band of a noise substantially. It is made to pass, without seeing substantially the signal which is small enough as for the reactance in the band of a source power supply of choke coils L3 and L4, and belongs to the band of a source power supply on the other hand, and generating loss.

[0057] If the noise generation source NS generates a noise where a switch SW2 is changed so that the edge of the direction which is not connected to the testing-machine-ed machine of a capacitor C3 may be grounded, the noise will be outputted from the outgoing end of the noise generation source NS, and will be supplied to one power-source input edge of a testing-machine-ed machine through a variable resistor VR 1 and a capacitor C4. A choke coil L4 prevents that the noise supplied through a capacitor C4 carries out splitting to one pole of a source power supply, and a choke coil L3 prevents that the noise supplied from one power-source input edge of a testing-machine-ed machine flows into the pole of another side of a source power supply via the power-source input edge of another side of a testing-machine-ed machine.

[0058] Therefore, the electrical potential difference which has an equal value substantially is impressed to the sum of the electrical potential difference supplied to the power-source input edge of the direction connected to the capacitor C4 among each power-source input edge of a testing-machine-ed machine through the variable resistor VR 1 and the capacitor C4 according to ** of superposition from the noise

generation source NS, and the electrical potential difference of a source power supply. That is, a normal mode noise is poured into a testing-machine-ed machine.
[0059] And the normal mode noise poured into the testing-machine-ed machine flows to a ground through the edge of the direction connected to the capacitor C3 among each power-source input edge of a testing-machine-ed machine, and a capacitor C3. For this reason, even if the reactance in the band of a noise of a choke coil L3 is large enough, a normal mode noise is efficiently poured into a testing-machine-ed machine.

[0060] Moreover, you may make it this noise transfer pipet inject into each power-source input edge of a testing-machine-ed machine the noise from which a polarity differs mutually, and, thereby, an equal quantity of a noise flows out of the power-source input edge of another side of a testing-machine-ed machine substantially with the amount of the noise which flowed at one power-source input edge of a testing-machine-ed machine. For this reason, it is avoided that a noise flows into the ground common to noise transfer pipet and a testing-machine-ed machine. Therefore, even if this noise transfer pipet does not have the testing-machine-ed machine and the common ground, it can pour the noise of normal mode into a testing-machine-ed machine, and even if it has the common ground, destabilization of the ground potential by the voltage drop generated according to the current which flows to the ground concerned is avoided.
[0061] The noise transfer pipet concerning the modification which injects into each power-source input edge of a testing-machine-ed machine the noise from which a polarity differs mutually has the configuration shown in drawing 5 . In addition to choke coils L3 and L4, capacitors C1 and C2, the noise generation source NS, a variable resistor VR 1, and a switch SW1, this noise transfer pipet consists of a transformer T and a capacitor C so that it may illustrate.
[0062] Choke coils L3 and L4 are substantially [as the thing in the noise transfer pipet shown in drawing 4] the same, a choke coil L3 is connected between a source power supply, and the node of a capacitor C1 and a testing-machine-ed machine, and a choke coil L4 is connected between a source power supply, and the node of a capacitor C2 and a testing-machine-ed machine.
[0063] The hot end of the primary winding of Transformer T is connected to the edge of the side which is not connected to the switch SW1 among the both ends of a variable resistor VR 1, and the cold end is grounded. The hot end of the secondary winding of Transformer T is connected to the end of Capacitor C, and a cold end is connected with a choke coil L4 at the node of a testing-machine-ed machine. The edge of the side which is not connected to Transformer T among the both ends of Capacitor C is connected with a choke coil L3 at the node of a testing-machine-ed machine.
[0064] If the noise generation source NS generates a current, the current will be outputted from the outgoing end of the noise generation source NS, and will be supplied to the primary winding of Transformer T through a variable resistor VR 1. Consequently, among the both ends of the secondary winding of Transformer T, the electrical potential difference proportional to the amplitude of the alternating component of the current supplied to the primary winding of Transformer T occurs. The electrical potential difference of the end of the secondary winding of Transformer T is supplied to one power-source input edge of a testing-machine-ed machine as a noise through Capacitor C, and the electrical potential difference of the other end is supplied to the power-source input edge of another side of a testing-machine-ed machine as a noise.
[0065] Preventing that the noise supplied through Capacitor C from the secondary winding of Transformer T carries out splitting of the choke coil L3 to one pole of a source power supply, a choke coil L4 prevents that the noise supplied from the secondary winding of Transformer T flows into the pole of another side of a source power supply.
[0066] Therefore, the electrical potential difference which has an equal value substantially is impressed to the sum of the electrical potential difference supplied to one power-source input edge of a testing-machine-ed machine through Capacitor C according to ** of superposition from the end of the secondary winding of Transformer T, and the electrical potential difference of a source power supply. Moreover, the electrical potential difference which has an equal value substantially is impressed to the sum of the electrical potential difference supplied to the power-source input edge of another side of a testing-machine-ed machine from the other end of the secondary winding of Transformer T according to ** of superposition, and the electrical potential difference of a source power supply.
[0067] And since the both ends of the secondary winding of Transformer T generate a mutually different polar electrical potential difference, the noise from which a polarity differs mutually is injected into each power-source input edge of a testing-machine-ed machine. Consequently, the noise of normal mode is poured into a testing-machine-ed machine through a ground loop.

[0068] The noise transfer pipet concerning the modification which injects into each power-source input edge of a testing-machine-ed machine the noise from which a polarity differs mutually may have the configuration shown not only in an above-mentioned thing but in drawing 6 . In addition to the same capacitors C1-C4, the noise generation source NS, and a switch SW1, this noise transfer pipet consists of a variable resistor VR 2 of three terminals, a buffer BUF, and an inversed amplifier INV as as substantially as what is shown in drawing 4 substantially as the same choke coils L3 and L4 and the thing shown in drawing 1 so that it may illustrate. However, the edge of the direction which the edge of the direction which is not connected to the testing-machine-ed machine among the both ends of a capacitor C3 is connected to the outgoing end which Buffer BUF mentions later, and is not connected to the testing-machine-ed machine among the both ends of a capacitor C4 is connected to the outgoing end which an inversed amplifier INV mentions later.

[0069] A variable resistor VR 2 outputs the electrical potential difference which pressured partially the electrical potential difference impressed between the 1st and 2nd terminals by the ratio according to actuation of an operator from the 3rd terminal. The 1st terminal of a variable resistor VR 2 is connected to the outgoing end of the noise generation source NS through a switch SW1, the 2nd terminal is grounded and the 3rd terminal is connected to the input edge of Buffer BUF and an inversed amplifier INV.

[0070] Buffer BUF is equipped with an input edge and an outgoing end, and outputs an equal electrical potential difference from an outgoing end substantially with the electrical potential difference impressed to the input edge. An inversed amplifier INV is also equipped with an input edge and an outgoing end, and supplies an equal electrical potential difference to the thing which had the sign of the electrical potential difference impressed to the input edge reversed from an outgoing end substantially. The outgoing end of Buffer BUF is connected to the edge of the side which is not connected to the power-source input edge of a testing-machine-ed machine among each edge of a capacitor C3, and the outgoing end of an inversed amplifier INV is connected to the edge of the side which is not connected to the power-source input edge of a testing-machine-ed machine among each edge of a capacitor C4.

[0071] In this noise transfer pipet, after the partial pressure of the electrical potential difference of the noise which the noise generation source NS outputted from the outgoing end is carried out with a variable resistor VR 2, it is impressed to the input edge of Buffer BUF and an inversed amplifier INV. While Buffer BUF outputs an equal electrical potential difference to the electrical potential difference impressed to the input edge substantially, since an inversed amplifier INV outputs an equal electrical potential difference to what reversed the polarity of the electrical potential difference impressed to the input edge substantially, the noise from which a polarity differs mutually is injected into each power-source input edge of a testing-machine-ed machine through capacitors C3 and C4. Consequently, the noise of normal mode is poured into a testing-machine-ed machine through a ground loop.

[0072] (Gestalt of the 2nd operation) In the gestalt of the 1st operation, although the noise was poured into the testing-machine-ed machine through the capacitor, the technique of pouring a noise into a testing-machine-ed machine is not restricted to the technique poured in through a capacitor. Below, the noise transfer pipet of the gestalt of the implementation of the 2nd of this invention which pours in a noise using a transformer is explained.

[0073] Drawing 7 shows the configuration of this noise transfer pipet. This noise transfer pipet consists of transformers T1 and T2, a noise generation source NS, and a variable resistor VR 1 and a switch SW1 so that it may illustrate. The noise generation source NS, and a variable resistor VR 1 and a switch SW1 are substantially [as the thing in the gestalt of the 1st operation] the same.

[0074] Each pole of a source power supply is connected to the cold end of the secondary winding of a transformer T1, and the cold end of the secondary winding of a transformer T2 1 to 1.

[0075] Each power-source input edge of the noise generation source NS is connected to 1 to 1 on each pole of a source power supply, an outgoing end is connected to the end of a switch SW1, and a touch-down edge is connected at the node of the cold and the comrades of the primary winding of transformers T1 and T2.

[0076] The end of a variable resistor VR 1 is connected at the node of the other ends of the primary winding of transformers T1 and T2, and the other end of a variable resistor VR 1 is connected to the edge of the side which is not connected to the noise generation source NS among each edge of a switch SW1.

[0077] Transformers T1 and T2 are for pouring into a testing-machine-ed machine the noise which the noise generation source NS generated. The hot end of the primary winding of a transformer T1 is connected to the power-source input edge of a testing-machine-ed machine, and the cold end is connected to one pole of a source power supply as above-mentioned. The hot end of the primary winding of a transformer T2 is connected to the power-source input edge of a testing-machine-ed machine, and a cold end is connected to

the pole of another side of a source power supply as above-mentioned. [illegible] and the comrades of the secondary winding of transformers T1 and T2 are connected mutually, and cold and comrades are also connected mutually.

[0078] The ratio of the number of turns of the primary winding of a transformer T1 and a secondary winding is substantially [identically / the inductance of the primary winding of a transformer T1 / as the inductance of the primary winding of a transformer T2] the same as substantially as the primary winding of a transformer T2, and the ratio of the number of turns of a secondary winding. For this reason, the current supplied from the noise generation source NS through a variable resistor VR 1 is mostly shunted toward division into equal parts at the primary winding of transformers T1 and T2, consequently induction of the mutual almost equal electromotive force is carried out for the amplitude to the secondary winding of transformers T1 and T2. And the polarity of this electromotive force becomes the same at the hot ends (and cold and comrades) of transformers T1 and T2.

[0079] Moreover, if the current of normal mode is supplied to each secondary winding from the two poles of a source power supply, in each secondary winding, back EMF of the sense which negates the current of the normal mode concerned will generate transformers T1 and T2 by the self-induction. On the other hand, the current of the normal mode supplied to the secondary winding of transformers T1 and T2 carries out induction of the electromotive force by mutual induction to each primary winding, and this electromotive force by which induction was carried out carries out induction of the electromotive force to a mutual secondary winding by mutual induction, as a result of passing a current to a mutual primary winding. And the electromotive force in which induction was carried out to the mutual secondary winding by mutual induction is sense which negates above-mentioned back EMF produced by the self-induction in each secondary winding.

[0080] For this reason, the electrical potential difference of the normal mode impressed from the two poles of a source power supply in order to supply the current of normal mode is supplied to a testing-machine-ed machine, without generating a voltage drop substantially in transformers T1 and T2. And the secondary winding of transformers T1 and T2 may have the big reactance in extent which makes the both ends generate a voltage drop substantially, when the signal belonging to the band of a source power supply is passed independently respectively.

[0081] From the outgoing end of the oscillator of the noise generation source NS, through a switch SW1 and a variable resistor VR 1, the alternating current which the noise generation source NS generates passes along a cold end from the hot end of the primary winding of transformers T1 and T2, and flows at the touch-down edge of an oscillator.

[0082] Consequently, in the secondary winding of transformers T1 and T2, the electromotive force of the magnitude proportional to the amplitude of the noise which the noise generation source NS generated arises. And this electromotive force supplies a noise to a testing-machine-ed machine. On the other hand, since the secondary winding of transformers T1 and T2 passes the current which a source power supply supplies, without producing substantial loss, the current supplied from a source power supply flows at the power-source input edge of a testing-machine-ed machine as it is.

[0083] Therefore, in each power-source input edge of a testing-machine-ed machine, the electrical potential difference which has an equal value substantially is impressed to the sum of the electrical potential difference produced in the secondary winding of transformers T1 and T2, and the electrical potential difference of a source power supply. And the component of a noise is substantially in phase mutually among the currents which flow at each power-source input edge of a testing-machine-ed machine. That is, the noise in the common mode is impressed to the power-source input edge of a testing-machine-ed machine.

[0084] In addition, the configuration of this noise transfer pipet is not restricted to an above-mentioned thing, either. For example, as shown in drawing 8 , this noise transfer pipet may be equipped with the switchable switch SW2 so that the hot end of the primary winding of a transformer T1 may be connected to the hot end of the primary winding of a transformer T2, and either of the grounds. When a noise is generated where a switch SW2 is changed so that the hot end of the primary coil of a transformer T1 may be grounded, a normal mode noise is poured into a testing-machine-ed machine.

[0085] In addition, also in the noise transfer pipet shown in drawing 8 , if the current of normal mode is supplied to each secondary winding from the two poles of a source power supply, in each secondary winding, back EMF of the sense which negates the current of the normal mode concerned will generate transformers T1 and T2 by the self-induction. On the other hand, the current of the normal mode supplied to the secondary winding of transformers T1 and T2 carries out induction of the electromotive force by mutual induction to each primary winding, and this electromotive force by which induction was carried out carries

out induction of the electromotive force to a mutual secondary winding by mutual induction, as a result of passing a current to a mutual primary winding.
[0086] However, when a noise is poured in where a switch SW2 is changed so that the hot end of the primary winding of a transformer T1 may be grounded, the back EMF concerned generated in the secondary winding of a transformer T1 is not negated by the electromotive force in which induction is carried out to the primary winding of a transformer T1 by mutual induction. However, the reactance of the transformer T1 seen from the both ends of the secondary winding of a transformer T1 since the both ends of the primary winding of a transformer T1 were short-circuited becomes small even to extent which a voltage drop does not produce substantially to the both ends of a transformer T1 also in the band of a source power supply in this case also in the band of the noise which the noise generation source NS generates.
[0087] Moreover, you may make it this noise transfer pipet pour the noise of normal mode into a testing-machine-ed machine through a ground loop by injecting into each power-source input edge of a testing-machine-ed machine the noise from which a polarity differs mutually.
[0088] What is necessary is just to specifically switch the condition that the hot end of the primary winding of a transformer T1 is connected to a variable resistor VR 1, and a cold end is grounded, and the condition that the cold end of the primary winding of a transformer T1 is connected to a variable resistor VR 1, and a hot end is grounded, with a noise mode circuit changing switch, as shown in drawing 9 .
[0089] A noise mode circuit changing switch is operated, and when the hot end of the primary winding of a transformer T1 considers as the condition that connect with a variable resistor VR 1 and a cold end is grounded, this noise transfer pipet performs actuation as already stated. On the other hand, when the cold end of the primary winding of a transformer T1 considers as the condition that connect with a variable resistor VR 1 and a hot end is grounded, in the secondary winding of a transformer T1, electromotive force with a reverse polarity occurs with the electromotive force by which induction is carried out to the secondary winding of a transformer T2. That is, when electromotive force has occurred in sense from which the hot end of the secondary winding of a transformer T2 serves as straight polarity, for example, to the secondary winding of a transformer T1, magnitude is substantially [as the electromotive force by which induction is carried out to the transformer T2] the same, and electromotive force of the sense with which a hot end serves as negative polarity occurs in it. [0090] Consequently, the noise from which a polarity differs mutually is injected into each power-source input edge of a testing-machine-ed machine, therefore the noise of normal mode is poured into a testing-machine-ed machine through a ground loop.
[0091] In addition, also in the noise transfer pipet shown in drawing 9 , if the current of normal mode is supplied to each secondary winding from the two poles of a source power supply, in each secondary winding, back EMF of the sense which negates the current of the normal mode concerned will generate transformers T1 and T2 by the self-induction. On the other hand, the current of the normal mode supplied to the secondary winding of transformers T1 and T2 carries out induction of the electromotive force by mutual induction to each primary winding, and this electromotive force by which induction was carried out carries out induction of the electromotive force to a mutual secondary winding by mutual induction, as a result of passing a current to a mutual primary winding. And when the noise mode circuit changing switch is set up so that the noise from which a polarity differs mutually may be injected into each power-source input edge of a testing-machine-ed machine, the sense of the back EMF concerned generated in the each second coil of transformers T1 and T2 becomes the same as that of the sense of the electromotive force concerned in which induction is carried out to these secondary windings by mutual induction.
[0092] In this case, it is set up so that it may have a reactance small to extent which a voltage drop does not produce substantially to each both ends when the signal with which these secondary windings belong to the band of a source power supply in order to make it a testing-machine-ed machine supplied, without the electrical potential difference of a source power supply generating a voltage drop substantially is passed independently respectively.
[0093] (Gestalt of the 3rd operation) In the gestalt of the 2nd operation, although the noise was poured into the testing-machine-ed machine through the transformer, the transformer may serve as the function which choke coils L1 and L2 are performing in the gestalt of the 2nd operation. Thereby, the impedance of the track to which the configuration of a circuit is simplified and each pole and testing-machine-ed machine of a source power supply are connected is low stopped compared with the gestalt of the 2nd operation, and supply of a power source is performed efficiently. Below, the noise transfer pipet of the gestalt of implementation of the 3rd of this invention on which the transformer which pours in a noise functions a choke coil is explained.
[0094] Drawing 10 shows the configuration of this noise transfer pipet. This noise transfer pipet consists of

transformer T3, a noise generation source NS, and a variable resistor VR 1 and a switch SW1 so that it may illustrate. The noise generation source NS, and a variable resistor VR 1 and a switch SW1 are substantially [as the 1st and the thing in the gestalt of the 2nd operation] the same.

[0095] Transformer T3 consists of three coils wound around the same core at TORIFAIRA, and, as for nothing and other two pieces, one of these three coils makes a separate secondary winding for a primary winding mutually. The number of turns of two secondary windings of transformer T3 are almost equal.

[0096] One [each] edge of two coils which make the secondary winding of transformer T3 is connected to 1 to 1 on each pole of a source power supply. Each edge of the direction connected to each pole of a source power supply of these two secondary windings is an edge by the side of the cut water of these coils, or these coils roll all and it is an edge by the side of an end.

[0097] For this reason, if the current of normal mode is supplied from the two poles of a source power supply, the each second coil of transformer T3 will carry out induction of the electromotive force of the sense which negates back EMF in which each carries out a self-induction according to the current which flows to each mutually by mutual induction. Consequently, the electromotive force to which the flowing current carries out induction of one secondary winding to the secondary winding of another side by mutual induction, and back EMF which the secondary winding of the another side concerned generated by the self-induction negate each other mutually.

[0098] And the edge of the direction which is not connected to each pole of a source power supply among the both ends of these [which make the secondary winding of transformer T3] two coils is connected to the power-source input edge of a testing-machine-ed machine 1 to 1. Therefore, the electrical potential difference of the normal mode impressed from the two poles of a source power supply in order to supply the current of normal mode is supplied to a testing-machine-ed machine, without generating a voltage drop substantially. In addition, the each second coil of transformer T3 may have the big reactance in extent which makes the both ends generate a voltage drop substantially, when the signal belonging to the band of a source power supply is passed independently respectively.

[0099] Each power-source input edge of the noise generation source NS is connected to 1 to 1 on each pole of a source power supply, an outgoing end is connected to the end of a switch SW1, and a touch-down edge is connected to the end of the primary winding of transformer T3. The end of a variable resistor VR 1 is connected to the other end of the primary winding of transformer T3, and the other end of a variable resistor VR 1 is connected to the edge of the side which is not connected to the noise generation source NS among each edge of a switch SW1.

[0100] From the outgoing end of the oscillator of the noise generation source NS, through a switch SW1 and a variable resistor VR 1, the alternating current which the noise generation source NS generates passes along the primary winding of transformer T3, and flows at the touch-down edge of an oscillator.

[0101] If a current is supplied to the primary winding of transformer T3, induction of the electromotive force by the mutual induction effect will be carried out to the each second coil of transformer T3. And the polarity of this electromotive force becomes the same at the edges by the side of the cut water of the each second coil of transformer T3 (and winding the edges by the side of an end).

[0102] And the amplitude of the electromotive force with which induction of the number of turns of the each second coil of transformer T3 is carried out to the each second coil since it is mutual almost equal serves as an equal mostly mutually. Therefore, in the each second coil of transformer T3, it is the magnitude proportional to the amplitude of the noise which the noise generation source NS generated, and the electromotive force of the mutual almost equal amplitude arises. And such electromotive force supplies a noise to a testing-machine-ed machine, without passing a current substantially to each pole of a source power supply.

[0103] On the other hand, since the each second coil of transformer T3 passes the current which a source power supply supplies, without producing substantial loss, the current supplied from a source power supply flows at the power-source input edge of a testing-machine-ed machine as it is.

[0104] Therefore, in each power-source input edge of a testing-machine-ed machine, the electrical potential difference which has an equal value substantially is impressed to the sum of the electrical potential difference produced in the each second coil of transformer T3, and the electrical potential difference of a source power supply. And the component of a noise is substantially in phase mutually among the currents which flow at each power-source input edge of a testing-machine-ed machine. That is, the noise in the common mode is impressed to the power-source input edge of a testing-machine-ed machine.

[0105] In addition, the configuration of this noise transfer pipet is not restricted to an above-mentioned thing, either. For example, three coils with which transformer T3 is equipped do not necessarily need to be

coiled around TORIFAIRA. Transformer T3 can just be connected wit[redacted]source power supply and a testing-machine-ed machine so that the polarity of the electromotive force in which the current which flows to the primary winding carries out induction to the each second coil by mutual induction may turn into the same polarity at the edges (or the edges connected to the testing-machine-ed machine) of the direction connected to the source power supply.

[0106] Moreover, you may make it this noise transfer pipet pour the noise of normal mode into a testing-machine-ed machine through a ground loop by injecting into each power-source input edge of a testing-machine-ed machine the noise from which a polarity differs mutually. Therefore, this noise transfer pipet may have the configuration shown in drawing 11 .

[0107] The each second coil of transformer T3 the noise transfer pipet of drawing 11 so that it may illustrate about one [(a), among those] secondary winding The near edge of the cut water of the secondary winding concerned is connected to one pole of a source power supply, it winds and the near edge of an end is connected to one power-source input edge of a testing-machine-ed machine. About the secondary winding of (b) another side Except for the point that the secondary winding concerned winds, the last near edge is connected to the pole of another side of a source power supply, and the near edge of a cut water is connected to the power-source input edge of another side of a testing-machine-ed machine, it has the same configuration substantially with the noise transfer pipet of drawing 10 .

[0108] In the noise transfer pipet of drawing 11 , if the alternating current which the noise generation source NS generates flows to the primary winding of transformer T3, one side will flow in the direction which faces to a testing-machine-ed machine from a source power supply, and one pair of induced currents by which induction is carried out to the each second coil of transformer T3 will flow in the direction in which another side goes to a source power supply from a testing-machine-ed machine.

[0109] Specifically for example, when electromotive force has occurred in sense from which the near edge of a volume first [each] serves as straight polarity at the each second coil of transformer T3, for example, the noise transfer pipet of drawing 11 performs actuation shown as (1) and (2) to below.

[0110] That is, the secondary winding of the direction where the near edge of (1) cut water is connected to the testing-machine-ed machine superimposes the induced current which has the magnitude which is proportional to the electromotive force which self has generated as a current component which constitutes a noise, and faces to a testing-machine-ed machine from a source power supply on the current which is flowing to self.

(2) On the other hand, the secondary winding of the direction where the near edge of a cut water is connected to the source power supply superimposes the induced current which has magnitude almost equal to the current component which the secondary winding of another side added in actuation of (1), and goes to a source power supply from a testing-machine-ed machine on the current which is flowing to self as a current component which constitutes a noise.

[0111] Consequently, the noise transfer pipet of drawing 11 injects into each power-source input edge of a testing-machine-ed machine the noise from which a polarity differs mutually. Therefore, the noise of normal mode is poured into a testing-machine-ed machine through a ground loop.

[0112] Furthermore, you may make it this noise transfer pipet inject either into each power-source input edge of a testing-machine-ed machine among the noise in the common mode, and the noise of normal mode according to a user's etc. actuation. What is necessary is just to specifically switch two conditions which show as (x) and (y) below with a noise mode circuit changing switch about one predetermined secondary winding of transformer T3, as shown in drawing 12 R> 2.

[0113] (x) -- the near edge of the cut water with the condition that connect with the predetermined pole of a source power supply, and wind and the near edge of an end is connected to the predetermined power-source input edge of a testing-machine-ed machine [namely,] (y) What is necessary is just to switch the condition that connect with the predetermined power-source input edge concerned of a testing-machine-ed machine, the near edge of the cut water winds, and the near edge of an end is connected to the predetermined pole concerned of a source power supply, with a noise mode circuit changing switch.

[0114] When a user etc. operates a noise mode circuit changing switch and makes this noise transfer pipet the condition of (x), the noise transfer pipet of drawing 12 performs the same actuation substantially with actuation of the noise transfer pipet of already described drawing 10 . On the other hand, when it considers as the condition of (y), the noise transfer pipet of drawing 12 performs the same actuation substantially with actuation of the noise transfer pipet of drawing 11 . That is, the noise transfer pipet of drawing 12 injects either into each power-source input edge of a testing-machine-ed machine among the noise in the common mode, and the noise of normal mode according to a user's etc. actuation.

[0115]
[Effect of the Invention] The noise transfer pipet and the noise impregnation approach of carrying out noise impregnation to power-source Rhine to insurance are realized without according to this invention, realizing small lightweight noise transfer pipet, and generating the high voltage in person, as explained above.

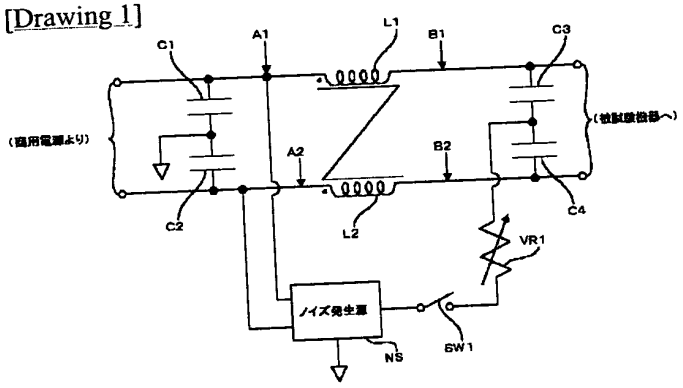
[Translation done.]

* NOTICES *

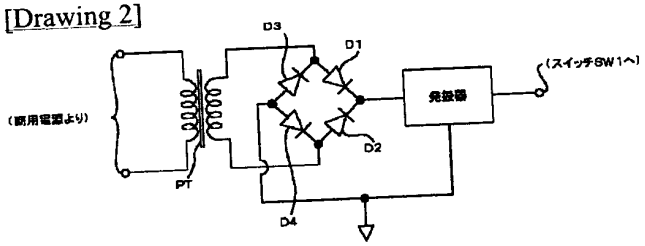
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

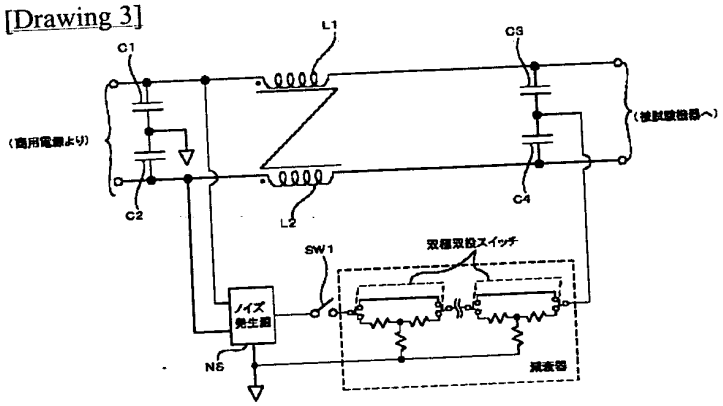
[Drawing 1]



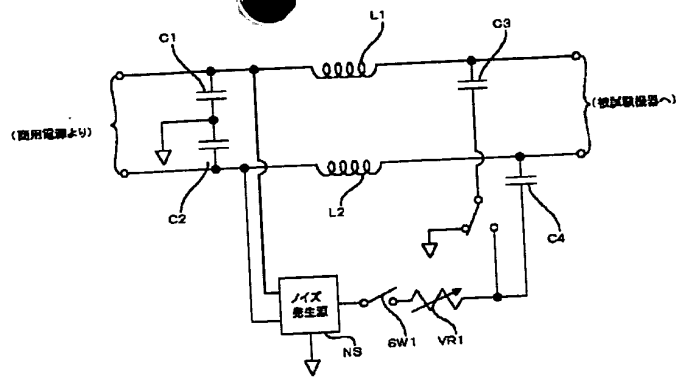
[Drawing 2]



[Drawing 3]



[Drawing 4]



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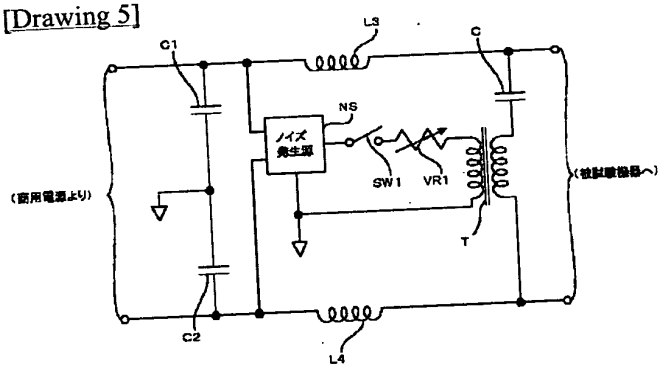

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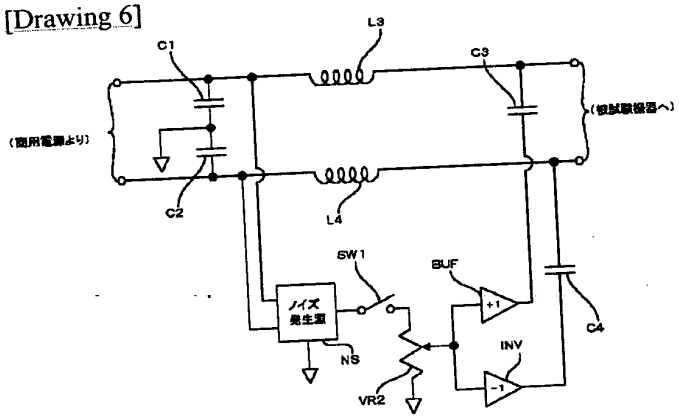

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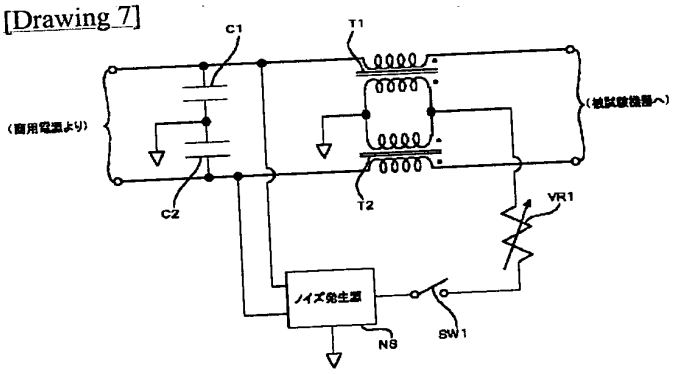

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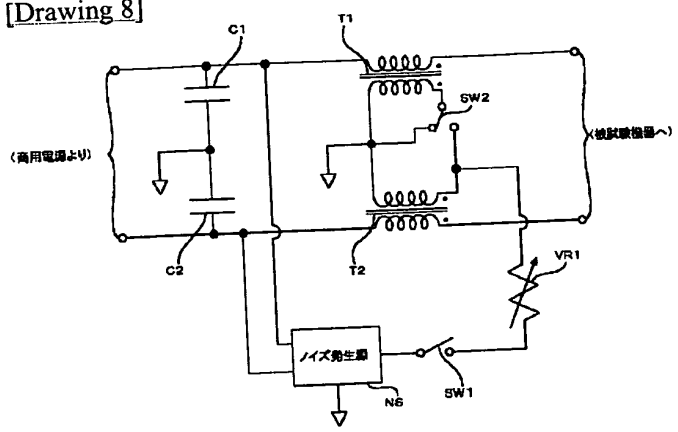
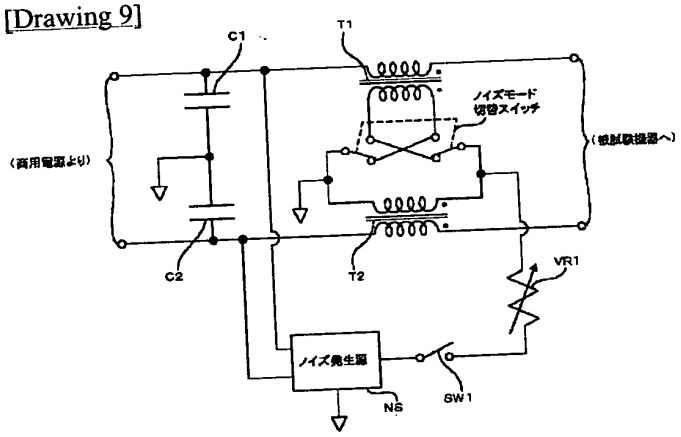
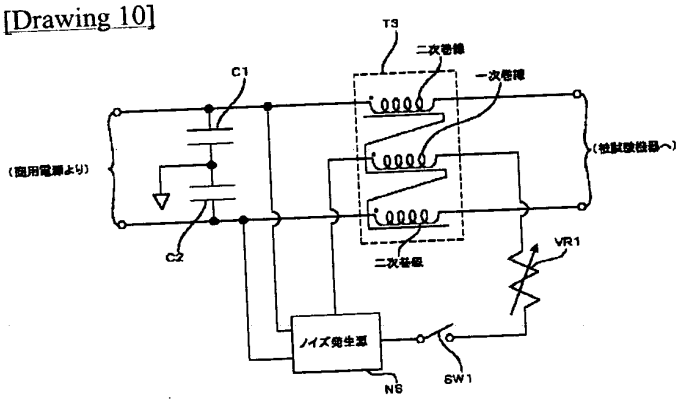


[Drawing 9]



[Drawing 10]



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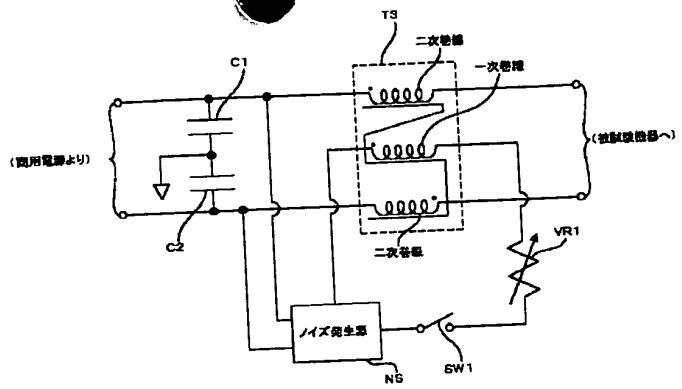

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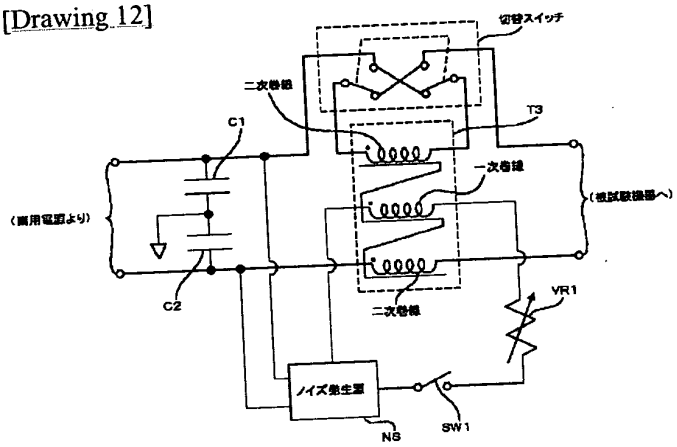

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(32)優先日　平９(1997)11月19日
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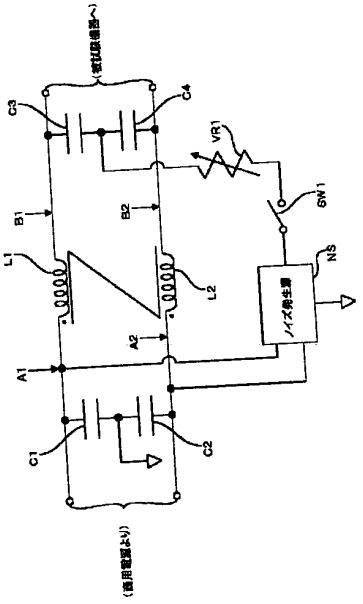
(54)【発明の名称】　ノイズ注入器及びノイズ注入方法

(57)【要約】
【課題】　小型軽量で、自身で高電圧を発生することなく、安全に電源ラインへのノイズ注入を行うことができるノイズ注入器等を提供することである。
【解決手段】　ノイズ発生源ＮＳがノイズを発生し、ノイズ試験の対象である被試験機器が備える１対の電源供給端に、スイッチＳＷ１、可変抵抗器ＶＲ１、コンデンサＣ１及びＣ２を介してこのノイズを供給する。このノイズは、単相交流の商用電源の各極と、被試験機器の電源供給端の間に接続されたチョークコイルＬ１及びＬ２により実質的に遮断されて、商用電源の側には供給されない。一方、商用電源が供給する電圧は、チョークコイルＬ１及びＬ２を介して被試験機器の電源供給端に供給される。このため、重ね合わせの理に従い、被試験機器の電源供給端には、ノイズ発生源ＮＳが供給するノイズと、商用電源が供給する電圧の和の電圧が印加される。



【特許請求の範囲】
【請求項１】１対の電源供給端を備える被試験機器に、各該電源供給端を介してノイズを供給するノイズ注入器において、
実質的に同相の１対のノイズを発生するノイズ発生手段と、
前記ノイズ発生手段が発生した前記１対のノイズを、外部の電源が供給する電力に重畳して前記１対の電源供給端に供給する電力重畳手段とを備え、
前記電力重畳手段は、各前記ノイズが前記外部の電源に向かって逆流するのを実質的に阻止するノイズ逆流防止手段を備える、
ことを特徴とするノイズ注入器。
【請求項２】前記ノイズ逆流防止手段は、前記外部の電源に向かって実質的に同相の１対の電流が通過するのを実質的に阻止する手段を備える、
ことを特徴とする請求項１に記載のノイズ注入器。
【請求項３】前記外部の電源は単相交流電源であり、
前記ノイズ逆流防止手段は、各々の一端が各前記電源供給端に接続され、各々の他端が、前記単相交流電源の各極に接続され、前記単相交流電源の周波数の電気信号を通過し、各前記ノイズの周波数の電気信号を実質的に遮断する１対のインダクタを備える、
ことを特徴とする請求項１又は２に記載のノイズ注入器。
【請求項４】前記１対のインダクタの各々は、前記単相交流電源から供給される単相交流電流により各自と対をなす前記インダクタが自己誘導する起電力を打ち消す向きの起電力を、各自と対をなす当該インダクタに相互誘導する誘導結合手段を備える、
ことを特徴とする請求項３に記載のノイズ注入器。
【請求項５】前記電力重畳手段は、前記１対のインダクタに、各前記ノイズの電圧を誘起させる相互誘導手段を備える、
ことを特徴とする請求項３又は４に記載のノイズ注入器。
【請求項６】前記相互誘導手段は、前記１対のインダクタが各前記ノイズの電圧を誘起するような磁束を前記１対のインダクタに共通に鎖交させる手段を備える、
ことを特徴とする請求項３、４又は５に記載のノイズ注入器。
【請求項７】前記電力重畳手段は、前記１対のインダクタと前記１対の電源供給端とを接続する線路に、各前記ノイズの電圧を印加する手段を備える、
ことを特徴とする請求項３又は４に記載のノイズ注入器。
【請求項８】前記電力重畳手段は、前記１対のインダクタと前記１対の電源供給端を接続する線路に、各前記ノイズの電流を誘起する手段を備える、
ことを特徴とする請求項３、４又は５に記載のノイズ注入器。
【請求項９】前記ノイズ発生手段は、前記外部の電源により駆動されて実質的に同相の１対のノイズを発生する手段を備える、
ことを特徴とする請求項１乃至８に記載のノイズ注入器。
【請求項１０】前記ノイズ発生手段は、互いに実質的に逆相の１対のノイズを発生する手段を備える、
ことを特徴とする請求項１乃至８に記載のノイズ注入器。
【請求項１１】前記外部の電源は単相交流電源であり、
前記ノイズ逆流防止手段は、各々の一端が各前記電源供給端に接続され、各々の他端が、前記単相交流電源の各極に接続され、前記単相交流電源の周波数の電気信号を通過し、各前記ノイズの周波数の電気信号を実質的に遮断する１対のインダクタを備え、
前記ノイズ発生手段は、ノイズ発生用のインダクタの両端に、互いに実質的に逆相の１対の前記ノイズの電圧を誘起する手段を備え、
前記電力重畳手段は、前記１対のインダクタと前記１対の電源供給端とを接続する線路に、前記ノイズ発生用のインダクタの各端に誘起された前記ノイズの電圧を印加する手段を備える、
ことを特徴とする請求項１０に記載のノイズ注入器。
【請求項１２】前記ノイズ発生手段は、外部からの操作に従って、前記１対の電源供給端に供給する各前記ノイズの量を加減する手段を備える、
ことを特徴とする請求項１乃至１１に記載のノイズ注入器。
【請求項１３】ノイズを発生するノイズ発生手段と、
電気機器が備える電源供給端と外部の電源が備える極との間に接続され、前記外部の電源から供給される電力を各前記電源供給端に供給し、前記ノイズを前記電力に重畳して各前記電源供給端に供給し、前記ノイズが前記外部の電源に供給されるのを実質的に阻止するノイズ逆流防止手段とを備える、
ことを特徴とするノイズ注入器。
【請求項１４】１対の電源供給端を備える被試験機器に、各該電源供給端を介してノイズを供給するノイズ注入方法において、
実質的に同相の１対のノイズを発生するノイズ発生ステップと、
前記ノイズ発生ステップが発生した前記１対のノイズを、外部の電源が供給する電力に重畳して前記１対の電源供給端に供給する電力重畳ステップとを備え、
前記電力重畳ステップは、各前記ノイズが前記外部の電源に向かって逆流するのを実質的に阻止するノイズ逆流防止ステップを備える、
ことを特徴とするノイズ注入方法。
【発明の詳細な説明】

【0001】
【発明の属する技術分野】この発明は、ノイズ注入器及びノイズ注入方法に関する。
【0002】
【従来の技術】従来、ノイズ（雑音）、特にコモンモードノイズ（すなわち、1対の線路の両方に、電流、電圧等の電気的変量が実質的に同相となるように印加されるノイズ）が電気機器に与える影響を調べる際、一般に、試験対象の電気機器（被試験機器）にノイズを注入して、被試験機器の動作を調べる手法がとられている。
【0003】被試験機器の電源ラインにノイズを注入する場合、従来は、被試験機器に供給すべき電源電圧にノイズを重畳したものに相当する電圧を生成して供給するノイズ注入器が、被試験機器に電源を供給している。
【0004】このようなノイズ注入器がコモンモードノイズを注入する場合は、ノイズ注入器と被試験機器とが接地電位を共通にする。そして、当該ノイズ注入器は、互いに位相がほぼ180度異なり、接地電位を基準とした平均電位が当該コモンモードノイズの瞬時値に等しい関係にある、二つの交流電圧を発生して、被試験機器に供給する手法により、コモンモードノイズを注入している。
【0005】
【発明が解決しようとする課題】しかし、この手法により、ノイズ注入器が商用電源に相当する電圧を供給する場合は、100ボルト程度の実効値を有する交流電圧を発生することになる。この場合、このようなノイズ注入器は、自ら高電圧を発生するため、操作の際、感電やスパーク等による災害を惹き起こす危険が大きい。
【0006】また、このようなノイズ注入器は、100ボルト程度の実効値を有する交流電圧を発生するために、数百ボルト程度の耐圧を有する大型のコンデンサ等の構成部品を備えている必要がある。このため、ノイズ注入器は大型で重くなり、取り扱いが困難になる。
【0007】この発明は上記実状に鑑みてなされたもので、小型軽量なノイズ注入器を提供すること、及び、自身で高電圧を発生することなく、安全に電源ラインへのノイズ注入を行うことができるノイズ注入器及びノイズ注入方法を提供することを目的とする。
【0008】
【課題を解決するための手段】上記目的を達成するため、この発明の第1の観点にかかるノイズ注入器は、1対の電源供給端を備える被試験機器に、各該電源供給端を介してノイズを供給するノイズ注入器において、実質的に同相の1対のノイズを発生するノイズ発生手段と、前記ノイズ発生手段が発生した前記1対のノイズを、外部の電源が供給する電力に重畳して前記1対の電源供給端に供給する電力重畳手段とを備え、前記電力重畳手段は、各前記ノイズが前記外部の電源に向かって逆流するのを実質的に阻止するノイズ逆流防止手段を備える、ことを特徴とする。
【0009】このようなノイズ注入器は、各前記ノイズを外部の電源から供給される前記電力に重畳するので、自ら電源電圧を発生することなく、安全に電源ラインへのコモンモードノイズの注入を行う。またこのようなノイズ注入器は、自ら電源電圧を発生することがないので、その電源電圧が高電圧であっても、高耐圧のコンデンサ等の大型で重い構成部品を備える必要がない。このため、このようなノイズ注入器は小型軽量となる。
【0010】前記ノイズ逆流防止手段は、前記外部の電源に向かって実質的に同相の1対の電流が通過するのを実質的に阻止する手段を備えるものとすれば、コモンモードノイズが前記外部の電源に流出することが防止される。このためコモンモードノイズの注入が効率化され、また、前記外部の電源に共通に接続されている他の電気機器へ、前記外部の電源を介して前記コモンモードノイズが流出することが回避される。
【0011】前記外部の電源は例えば単相交流電源であり、その場合、前記ノイズ逆流防止手段は、例えば、各々の一端が各前記電源供給端に接続され、各々の他端が、前記単相交流電源の各極に接続され、前記単相交流電源の周波数の電気信号を通過し、各前記ノイズの周波数の電気信号を実質的に遮断する1対のインダクタを備えるものであってもよい。
【0012】前記1対のインダクタの各々は、前記単相交流電源から供給される単相交流電流により各自と対をなす前記インダクタが自己誘導する起電力を打ち消す向きの起電力を、各自と対をなす当該インダクタに相互誘導する誘導結合手段を備えるものとすれば、前記単相交流電源から供給されるコモンモードのノイズが前記電気機器に供給されることが阻止される。また、前記単相交流電源から供給される単相交流電流により前記1対のインダクタが自己誘導する起電力により前記単相交流電源が供給する電圧が相殺される事態も阻止され、電源の供給は効率的になる。
【0013】前記電力重畳手段は、前記1対のインダクタに、各前記ノイズの電圧を誘起させる相互誘導手段を備えるものであってもよい。これにより、前記1対のインダクタ自身がノイズを発生するので、このノイズ注入器の構成は簡略化され、また、小型軽量に構成されるようになる。また、前記外部の電源と前記被試験機器とを結ぶ線路のインピーダンスが低く抑えられるため、電源の供給が効率的に行われる。
【0014】前記相互誘導手段は、例えば、前記1対のインダクタが各前記ノイズの電圧を誘起するような磁束を前記1対のインダクタに共通に鎖交させる手段を備えることにより、前記1対のインダクタ自身にノイズを発生させる。
【0015】前記電力重畳手段は、例えば、前記1対のインダクタと前記1対の電源供給端とを接続する線路

に、各前記ノイズの電圧を印加する手段を備えることにより前記ノイズを前記電気機器に注入するものであってもよいし、また、前記電力重畳手段は、例えば、前記１対のインダクタと前記１対の電源供給端を接続する線路に、各前記ノイズの電流を誘起する手段を備えることにより前記ノイズを前記電気機器に注入するものであってもよい。

【００１６】前記ノイズ発生手段は、前記外部の電源により駆動されて実質的に同相の１対のノイズを発生する手段を備えるものとすれば、前記ノイズ注入器は、電源を供給する手段を自らが備えることなく前記電気機器に前記ノイズを供給するので、前記ノイズ注入器は小型軽量となる。

【００１７】前記ノイズ発生手段は、互いに実質的に逆相の１対のノイズを発生する手段を備えるものとすれば、前記ノイズ注入器は、前記電気機器と共通のグラウンドを有することを要せずに、ノーマルモードのノイズを前記電気機器に注入する。

【００１８】この場合において、前記外部の電源が例えば単相交流電源であれば、例えば、前記ノイズ逆流防止手段は、各々の一端が各前記電源供給端に接続され、各々の他端が、前記単相交流電源の各極に接続され、前記単相交流電源の周波数の電気信号を通過し、各前記ノイズの周波数の電気信号を実質的に遮断する１対のインダクタを備え、前記ノイズ発生手段は、ノイズ発生用のインダクタの両端に、互いに実質的に逆相の１対の前記ノイズの電圧を誘起する手段を備え、前記電力重畳手段は、前記１対のインダクタと前記１対の電源供給端とを接続する線路に、前記ノイズ発生用のインダクタの各端に誘起された前記ノイズの電圧を印加する手段を備える、ものとすることにより、前記ノイズ注入器は、前記ノーマルモードのノイズを前記電気機器に注入する。

【００１９】前記ノイズ発生手段は、外部からの操作に従って、前記１対の電源供給端に供給する各前記ノイズの量を加減する手段を備えるものとすれば、操作者の操作に応じた量の前記ノイズが前記電気機器に注入される。

【００２０】また、この発明の第２の観点にかかるノイズ注入器は、ノイズを発生するノイズ発生手段と、電気機器が備える電源供給端と外部の電源が備える極との間に接続され、前記外部の電源から供給される電力を各前記電源供給端に供給し、前記ノイズを前記電力に重畳して各前記電源供給端に供給し、前記ノイズが前記外部の電源に供給されるのを実質的に阻止するノイズ逆流防止手段とを備える、ことを特徴とする。

【００２１】このようなノイズ注入器は、前記ノイズを外部の電源から供給される前記電力に重畳するので、自ら電源電圧を発生することなく、安全に電源ラインへのノイズの注入を行う。またこのようなノイズ注入器も、自ら電源電圧を発生することがないので、その電源電圧が高電圧であっても、高耐圧のコンデンサ等の大型で重い構成部品を備える必要がない。このため、このようなノイズ注入器は小型軽量となる。

【００２２】また、この発明の第３の観点にかかるノイズ注入方法は、１対の電源供給端を備える被試験機器に、各該電源供給端を介してノイズを供給するノイズ注入方法において、実質的に同相の１対のノイズを発生するノイズ発生ステップと、前記ノイズ発生ステップが発生した前記１対のノイズを、外部の電源が供給する電力に重畳して前記１対の電源供給端に供給する電力重畳ステップとを備え、前記電力重畳ステップは、各前記ノイズが前記外部の電源に向かって逆流するのを実質的に阻止するノイズ逆流防止ステップを備える、ことを特徴とする。

【００２３】このようなノイズ注入方法によれば、各前記ノイズが外部の電源から供給される前記電力に重畳されるので、自ら電源電圧を発生するステップを要せずに、安全に電源ラインへのコモンモードノイズの注入が行われる。

【００２４】

【発明の実施の形態】以下、この発明の実施の形態にかかるノイズ注入器及びノイズ注入方法を、単相交流の商用電源を用いる被試験機器にノイズを注入するためのノイズ注入器を例として説明する。

【００２５】（第１の実施の形態）図１は、この発明の第１の実施の形態にかかるノイズ注入器の構成を示す。図示するように、このノイズ注入器は、チョークコイルＬ１及びＬ２と、コンデンサＣ１～Ｃ４と、ノイズ発生源ＮＳと、可変抵抗器ＶＲ１と、スイッチＳＷ１とより構成される。

【００２６】チョークコイルＬ１及びＬ２は、商用電源に含まれる高調波成分を除去するとともに、ノイズ発生源ＮＳが発生するノイズが、図１に示す点Ａ１－点Ｂ１間及び点Ａ２－点Ｂ２間の線路を通過するのを阻止するためのものである。

【００２７】チョークコイルＬ１及びＬ２のそれぞれの一端には、商用電源の１対の極が１対１に接続され、チョークコイルＬ１及びＬ２のそれぞれの他端は、ノイズ試験の対象である被試験機器が備える電源入力端に１対１に接続される。

【００２８】チョークコイルＬ１及びＬ２のインダクタンスの値は、チョークコイルＬ１及びＬ２が、ノイズ発生源ＮＳが発生するノイズの周波数帯域に属する電気信号の通過を阻止する程度に大きな値である。ただし、チョークコイルＬ１及びＬ２のインダクタンスの値は、チョークコイルＬ１及びＬ２が、商用電源の周波数帯域に属する電気信号を、実質的にみて損失を生じることなく通過させる程度に小さな値である。

【００２９】また、チョークコイルＬ１及びＬ２は、例えば、同一のコアにバイファイラに巻かれたコイルから

なり、チョークコイルＬ１及びＬ２の、商用電源の各極に接続されている方の端は、いずれも該コイルの巻き始め側の端であるか、又はいずれも該コイルの巻き終わり側の端である。

【００３０】商用電源の両極から互いに実質的に逆相の電流（すなわち、ノーマルモードの電流）が供給されると、チョークコイルＬ１及びＬ２は、各々に流れる電流により各々が自己誘導する逆起電力を打ち消す向きの起電力を、相互誘導により互いに誘起し合う。

【００３１】例えば、チョークコイルＬ１に、被試験機器に接続された側の端から商用電源に接続された側の端に流れる電流が流れると、チョークコイルＬ１には、自己誘導により、商用電源に接続された側の端から被試験機器に接続された側の端に電流を流す向きの逆起電力が発生する。一方、チョークコイルＬ１に、被試験機器に接続された側の端から商用電源に接続された側の端に流れる電流が流れる間、チョークコイルＬ２には、商用電源に接続された側の端から被試験機器に接続された側の端に電流が流れる。そして、この電流は、チョークコイルＬ１に、その被試験機器に接続された側の端から商用電源に接続された側の端に電流を流す向きの起電力を、相互誘導により誘起する。

【００３２】この結果、チョークコイルＬ１が自己誘導により発生した逆起電力と、チョークコイルＬ２を流れる電流が相互誘導によりチョークコイルＬ１に誘起した起電力とは、互いを打ち消し合う。また同様に、チョークコイルＬ２が自己誘導により発生した逆起電力、及びチョークコイルＬ１を流れる電流が相互誘導によりチョークコイルＬ２に誘起した起電力も、互いを打ち消し合う。

【００３３】このため、商用電源の両極から、ノーマルモードの電流を供給するために印加されるノーマルモードの電圧は、実質的に電圧降下を発生させることなく、被試験機器に供給される。そして、チョークコイルＬ１及びＬ２は、商用電源の帯域に属する信号を各々単独に通過させた場合において、その両端に実質的に電圧降下を発生させる程度に大きなリアクタンスを有していてもよい。

【００３４】一方、チョークコイルＬ１及びＬ２の、被試験機器に接続された側の端に、互いに実質的に同相の電流（すなわち、コモンモードの電流）が供給された場合、チョークコイルＬ１及びＬ２を流れる当該コモンモードの電流により各々が自己誘導する逆起電力は、相互誘導により発生する起電力によっては打ち消されない。

【００３５】例えば、チョークコイルＬ１が自己誘導により発生した逆起電力と、チョークコイルＬ２を流れる電流が相互誘導によりチョークコイルＬ１に誘起した起電力とは、同一の向きとなる。また同様に、チョークコイルＬ２が自己誘導により発生した逆起電力、及びチョークコイルＬ１を流れる電流が相互誘導によりチョークコイルＬ２に誘起した起電力も、同一の向きとなる。

【００３６】このため、チョークコイルＬ１及びＬ２の、被試験機器に接続された側の端にコモンモードノイズが供給された場合、当該コモンモードノイズは、チョークコイルＬ１及びＬ２を流れる電流により各々が自己誘導する逆起電力と、相互誘導により発生する起電力とによって、商用電源の各極への流入が阻止される。

【００３７】コンデンサＣ１及びＣ２は、商用電源の両極の電位に基づいて、グラウンド電位を発生させるためのものである。コンデンサＣ１及びＣ２はカスケードに接続され、両者の接続点は接地される。コンデンサＣ１の各端のうち、コンデンサＣ２に接続されていない側の端は、商用電源とチョークコイルＬ１との接続点に接続され、コンデンサＣ２の各端のうち、コンデンサＣ１に接続されていない側の端は、商用電源とチョークコイルＬ２との接続点に接続される。コンデンサＣ１及びＣ２の静電容量は互いに実質的に等しく、このため、コンデンサＣ１及びＣ２の接続点の電位の値は、商用電源の両極の電位の値を算術平均したものに実質的に等しい。

【００３８】コンデンサＣ３及びＣ４は、ノイズ発生源ＮＳが発生したノイズを被試験機器に注入するためのものである。コンデンサＣ３及びＣ４はカスケードに接続され、両者の接続点は、可変抵抗器ＶＲ１の一端に接続される。コンデンサＣ３の各端のうち、コンデンサＣ４に接続されていない側の端は、被試験機器とチョークコイルＬ１との接続点に接続され、コンデンサＣ４の各端のうち、コンデンサＣ３に接続されていない側の端は、被試験機器とチョークコイルＬ２との接続点に接続される。

【００３９】ノイズ発生源ＮＳは、ブロッキング発振回路等からなる発振器を備え、被試験機器に注入するためのノイズを発生する。ノイズ発生源ＮＳは、自らが備える発振器を駆動する電源を得るための１対の電源入力端と、ノイズとなる交流電圧を出力する出力端と、図示しない接地端を備える。各電源入力端は、商用電源の各極に１対１に接続され、出力端は、スイッチＳＷ１の一端に接続され、接地端は接地される。

【００４０】ノイズ発生源ＮＳは、各電源入力端に商用電源が供給されると、例えば図２に示すように、その商用電源を変成器ＰＴにより変圧した後ブリッジ接続されたダイオードＤ１～Ｄ４により整流し、発振器を駆動するための直流電圧を生成する。この直流電圧により駆動された発振器は、商用電源の周波数より高い周波数成分を含み、直流成分の電位の値が商用電源の両極の電位の算術平均の値に実質的に等しい信号をノイズとして発生し、当該ノイズをスイッチＳＷ１の一端に印加する。

【００４１】そして、被試験機器のグラウンド電位は、例えば、被試験機器が備える接地端を、ノイズ発生源ＮＳの接地端に接続することにより、ノイズ発生源ＮＳの電位（すなわち、コンデンサＣ１とＣ２との接続点の電

位）と実質的に同一に保たれる。これにより、商用電源の各極の電位の直流分の変動が、コモンモードノイズとして被試験機器に印加されることが回避される。

【００４２】可変抵抗器ＶＲ１は、被試験機器に注入されるノイズの量を調整するためのものである。可変抵抗器ＶＲ１の一端は上述の通りコンデンサＣ３及びＣ４に接続され、他端は、スイッチＳＷ１の両端のうち、ノイズ発生源ＮＳに接続されていない側の端に接続される。

【００４３】ノイズは、ノイズ発生源ＮＳの出力端より出力され、可変抵抗器ＶＲ１と、コンデンサＣ３及びＣ４を介して、被試験機器に供給される。

【００４４】ノイズの帯域におけるチョークコイルＬ１及びＬ２のリアクタンスは十分大きく、ノイズの帯域に属する信号を実質的に遮断する。また、ノイズを供給されたチョークコイルＬ１及びＬ２が自己誘導する逆起電力や、ノイズを供給されたチョークコイルＬ１及びＬ２が相互誘導により互いに誘起し合う起電力は、ノイズがチョークコイルＬ１及びＬ２を通過するのを阻止する。このため、ノイズ発生源ＮＳが発生するノイズは、可変抵抗器ＶＲ１と、コンデンサＣ３及びＣ４を介して、商用電源の各極に実質的に分流することなく、被試験機器に供給される。

【００４５】一方、商用電源から供給されるノーマルモードの電流がチョークコイルＬ１及びＬ２を流れることにより、チョークコイルＬ１及びＬ２には、自己誘導による逆起電力が発生する。しかしこれらの逆起電力は、チョークコイルＬ１及びＬ２が相互誘導により互いに誘起し合う起電力により減殺される。このため、商用電源から供給される電圧は、チョークコイルＬ１及びＬ２において実質的に電圧降下を発生させることなく、被試験機器の電源入力端に供給される。

【００４６】従って、被試験機器の各電源入力端には、重ね合わせの理に従い、ノイズ発生源ＮＳから可変抵抗器ＶＲ１及びコンデンサＣ３、Ｃ４を介して供給された電圧と商用電源の電圧の和に実質的に等しい値を有する電圧が印加される。そして、被試験機器の各電源入力端に印加される電圧のうちノイズの成分は互いに実質的に同相である。すなわち、被試験機器の電源入力端には、コモンモードのノイズが印加される。

【００４７】被試験機器は、このノイズ注入器から供給されるノイズを含む電力を電源として取得し、駆動する。そして、ノイズ注入器から供給されるノイズによる動作状態を試験することにより、各種のノイズ試験が実行される。

【００４８】具体的には、例えば、ノイズ注入器を電源として用いた場合の被試験機器の動作と、ノイズを含まない電源を用いた場合の被試験機器の動作とが比較される。また、駆動時に電気信号を出力する被試験機器の場合は、例えば、出力される電気信号の同相電圧除去比（すなわち、注入されたノイズの振幅と当該電気信号に含まれるノイズ成分の振幅の比）が測定される。

【００４９】なお、このノイズ注入器の構成は、上述のものに限られない。例えば、ノイズの注入量は、可変抵抗器ＶＲ１によって調整される必要はなく、ノイズの注入量は固定されていてもよい。

【００５０】また、ノイズ発生源ＮＳの発振器は、商用電源を変圧及び整流して得られる電圧により駆動される必要はなく、例えば電池等の外部の電源により駆動されてもよい。この場合、ノイズ発生源ＮＳは商用電源の両極に接続されている必要はなく、また変成器ＰＴやダイオードＤ１～Ｄ４は不要である。

【００５１】また、このノイズ注入器は、可変抵抗器ＶＲ１に代えて、例えば図３に示すような減衰器を備えていてもよい。図示するように、この減衰器は、各々が「Ｔ」字型に接続された３個の抵抗器からなる段を複数備える。各段を形成する抵抗器のうち、一端が接地端に接続されている１個を除く抵抗器は互いにカスケードに接続されている。カスケードに接続された抵抗器が形成する直列回路の一方の端は、スイッチＳＷ１を介してノイズ発生源ＮＳの出力端に接続され、他方の端はコンデンサＣ３及びＣ４の接続点に接続される。そして、接地端は、ノイズ発生源ＮＳの接地端に接続されている。

【００５２】またこの減衰器は、各段を、操作者の操作に従ってこの減衰器から電気的に切り離し、切り離された各段を電気的にバイパスするための複数の双極双投スイッチを備える。そして、この減衰器を形成する各抵抗器の抵抗値は、各段の抵抗器がこの減衰器から電気的に切り離されているか否かにかかわらず、コンデンサＣ３及びＣ４の接続点からみたこの減衰器のインピーダンスが実質的に一定の値となるように選ばれている。

【００５３】このような減衰器を備えたノイズ注入器では、ノイズの出力インピーダンスは、被試験機器の電源供給端から見て、ノイズの注入量にかかわらず実質的に一定である。このため、被試験機器に注入するノイズの量を正確にコントロールすることができる。

【００５４】また、このノイズ注入器は、ノーマルモードノイズ（すなわち、１対の線路の一方に印加されるノイズ）を供給するため、例えば図４に示すように、図１のノイズ注入器におけるものと実質的に同一のコンデンサＣ１～Ｃ４、ノイズ発生源ＮＳ、可変抵抗器ＶＲ１、スイッチＳＷ１に加え、スイッチＳＷ２と、チョークコイルＬ３及びＬ４とを備えていてもよい。

【００５５】スイッチＳＷ２は双極単投のスイッチから構成され、コンデンサＣ３のうち被試験機器に接続されていない方の端を、可変抵抗器ＶＲ１及びグラウンドのいずれか一方に接続されるように切り替え可能である。チョークコイルＬ３は、被試験機器及びコンデンサＣ３の接続点と、商用電源及びコンデンサＣ１の接続点との間に接続される。チョークコイルＬ４は、被試験機器及びコンデンサＣ４の接続点と、商用電源及びコンデンサ

Ｃ２の接続点との間に接続される。

【００５６】チョークコイルＬ３及びＬ４の、ノイズの帯域におけるリアクタンスは十分大きく、ノイズの帯域に属する信号を実質的に遮断する。一方、チョークコイルＬ３及びＬ４の、商用電源の帯域におけるリアクタンスは十分小さく、商用電源の帯域に属する信号を、実質的にみて損失を発生することなく通過させる。

【００５７】コンデンサＣ３の、被試験機器に接続されていない方の端が接地されるようにスイッチＳＷ２が切り替えられた状態でノイズ発生源ＮＳがノイズを発生すると、そのノイズは、ノイズ発生源ＮＳの出力端より出力され、可変抵抗器ＶＲ１と、コンデンサＣ４を介して、被試験機器の一方の電源入力端に供給される。チョークコイルＬ４は、コンデンサＣ４を介して供給されるノイズが、商用電源の一方の極に分流するのを阻止し、チョークコイルＬ３は、被試験機器の一方の電源入力端から供給されるノイズが、被試験機器の他方の電源入力端を経由して、商用電源の他方の極に流入するのを阻止する。

【００５８】従って、被試験機器の各電源入力端のうち、コンデンサＣ４に接続されている方の電源入力端には、重ね合わせの理に従い、ノイズ発生源ＮＳから可変抵抗器ＶＲ１及びコンデンサＣ４を介して供給された電圧と商用電源の電圧の和に実質的に等しい値を有する電圧が印加される。すなわち、被試験機器にノーマルモードノイズが注入される。

【００５９】そして、被試験機器に注入されたノーマルモードノイズは、被試験機器の各電源入力端のうち、コンデンサＣ３に接続された方の端と、コンデンサＣ３とを経て、グラウンドに流れる。このため、チョークコイルＬ３の、ノイズの帯域におけるリアクタンスが十分大きくても、被試験機器にはノーマルモードノイズが効率的に注入される。

【００６０】また、このノイズ注入器は、被試験機器の各電源入力端に、互いに極性が異なるノイズを注入するようにしてもよく、これにより、被試験機器の一方の電源入力端に流入したノイズの量と実質的に等しい量のノイズが、被試験機器の他方の電源入力端から流出する。このため、ノイズが、ノイズ注入器及び被試験機器に共通するグラウンドに流出することが避けられる。従って、このノイズ注入器は、被試験機器と共通のグラウンドを有していなくても、被試験機器にノーマルモードのノイズを注入することができ、また、共通のグラウンドを有していても、当該グラウンドに流れる電流により発生する電圧降下によるグラウンド電位の不安定化が避けられる。

【００６１】互いに極性が異なるノイズを被試験機器の各電源入力端に注入する変形例にかかるノイズ注入器は、例えば図５に示す構成を有する。図示するように、このノイズ注入器は、チョークコイルＬ３及びＬ４、コンデンサＣ１及びＣ２、ノイズ発生源ＮＳ、可変抵抗器ＶＲ１、スイッチＳＷ１に加え、変成器Ｔと、コンデンサＣとより構成される。

【００６２】チョークコイルＬ３及びＬ４は、図４に示すノイズ注入器におけるものと実質的に同一のものであり、チョークコイルＬ３は、商用電源及びコンデンサＣ１の接続点と被試験機器との間に接続され、チョークコイルＬ４は、商用電源及びコンデンサＣ２の接続点と被試験機器との間に接続される。

【００６３】変成器Ｔの一次巻線のホットエンドは、可変抵抗器ＶＲ１の両端のうち、スイッチＳＷ１に接続されていない側の端に接続されており、コールドエンドは接地されている。変成器Ｔの二次巻線のホットエンドはコンデンサＣの一端に接続され、コールドエンドは、チョークコイルＬ４と被試験機器の接続点に接続される。コンデンサＣの両端のうち、変成器Ｔに接続されていない側の端は、チョークコイルＬ３と被試験機器の接続点に接続される。

【００６４】ノイズ発生源ＮＳが電流を発生すると、その電流は、ノイズ発生源ＮＳの出力端より出力され、可変抵抗器ＶＲ１を介して、変成器Ｔの一次巻線に供給される。この結果、変成器Ｔの二次巻線の両端間には、変成器Ｔの一次巻線に供給された電流の交流分の振幅に比例した電圧が発生する。変成器Ｔの二次巻線の一端の電圧は、コンデンサＣを介して被試験機器の一方の電源入力端にノイズとして供給され、他端の電圧は、被試験機器の他方の電源入力端にノイズとして供給される。

【００６５】チョークコイルＬ３は、変圧器Ｔの二次巻線からコンデンサＣを介して供給されるノイズが商用電源の一方の極に分流するのを阻止し、チョークコイルＬ４は、変圧器Ｔの二次巻線から供給されるノイズが商用電源の他方の極に流入するのを阻止する。

【００６６】従って、被試験機器の一方の電源入力端には、重ね合わせの理に従い、変圧器Ｔの二次巻線の一端からコンデンサＣを介して供給された電圧と商用電源の電圧の和に実質的に等しい値を有する電圧が印加される。また、被試験機器の他方の電源入力端には、重ね合わせの理に従い、変圧器Ｔの二次巻線の他端から供給された電圧と商用電源の電圧の和に実質的に等しい値を有する電圧が印加される。

【００６７】そして、変圧器Ｔの二次巻線の両端は、互いに異なる極性の電圧を発生するので、被試験機器の各電源入力端には、互いに極性が異なるノイズが注入される。この結果、被試験機器に、グラウンドループを介することなくノーマルモードのノイズが注入される。

【００６８】互いに極性が異なるノイズを被試験機器の各電源入力端に注入する変形例にかかるノイズ注入器は、上述のものに限らず、例えば図６に示す構成を有していてもよい。図示するように、このノイズ注入器は、図４に示すものと実質的に同一のチョークコイルＬ３及

びＬ４と、図１に示すものと実質的に同一のコンデンサＣ１～Ｃ４、ノイズ発生源ＮＳ及びスイッチＳＷ１に加え、３端子の可変抵抗器ＶＲ２と、バッファＢＵＦと、反転増幅器ＩＮＶとより構成される。ただし、コンデンサＣ３の両端のうち被試験機器に接続されていない方の端はバッファＢＵＦの後述する出力端に接続され、コンデンサＣ４の両端のうち被試験機器に接続されていない方の端は反転増幅器ＩＮＶの後述する出力端に接続されている。

【００６９】可変抵抗器ＶＲ２は、第１及び第２の端子間に印加された電圧を操作者の操作に従った比率で分圧した電圧を第３の端子から出力するものである。可変抵抗器ＶＲ２の第１の端子は、スイッチＳＷ１を介してノイズ発生源ＮＳの出力端に接続され、第２の端子は接地され、第３の端子はバッファＢＵＦ及び反転増幅器ＩＮＶの入力端に接続される。

【００７０】バッファＢＵＦは、入力端と出力端を備え、入力端に印加された電圧と実質的に等しい電圧を出力端から出力する。反転増幅器ＩＮＶも入力端と出力端を備え、入力端に印加された電圧の符号を逆転されたものに実質的に等しい電圧を出力端から供給する。バッファＢＵＦの出力端は、コンデンサＣ３の各端のうち、被試験機器の電源入力端に接続されていない側の端に接続され、反転増幅器ＩＮＶの出力端は、コンデンサＣ４の各端のうち、被試験機器の電源入力端に接続されていない側の端に接続される。

【００７１】このノイズ注入器においては、ノイズ発生源ＮＳが出力端より出力したノイズの電圧は可変抵抗器ＶＲ２により分圧された後、バッファＢＵＦ及び反転増幅器ＩＮＶの入力端に印加される。バッファＢＵＦは、入力端に印加された電圧に実質的に等しい電圧を出力する一方、反転増幅器ＩＮＶは、入力端に印加された電圧の極性を反転したものに実質的に等しい電圧を出力するので、被試験機器の各電源入力端には、コンデンサＣ３、Ｃ４を介して、互いに極性が異なるノイズが注入される。この結果、被試験機器に、グラウンドループを介することなくノーマルモードのノイズが注入される。

【００７２】（第２の実施の形態）第１の実施の形態において、ノイズはコンデンサを介して被試験機器に注入されていたが、被試験機器にノイズを注入する手法は、コンデンサを介して注入する手法に限られない。以下では、変成器を用いてノイズの注入を行う、この発明の第２の実施の形態のノイズ注入器を説明する。

【００７３】図７は、このノイズ注入器の構成を示す。図示するように、このノイズ注入器は、変成器Ｔ１及びＴ２と、ノイズ発生源ＮＳと、可変抵抗器ＶＲ１と、スイッチＳＷ１とより構成される。ノイズ発生源ＮＳと、可変抵抗器ＶＲ１と、スイッチＳＷ１は、第１の実施の形態におけるものと実質的に同一のものである。

【００７４】商用電源の各極は、変成器Ｔ１の二次巻線のコールドエンドと、変成器Ｔ２の二次巻線のコールドエンドとに１対１に接続される。

【００７５】ノイズ発生源ＮＳの各電源入力端は、商用電源の各極に１対１に接続され、出力端は、スイッチＳＷ１の一端に接続され、接地端は、変成器Ｔ１及びＴ２の一次巻線のコールドエンド同士の接続点に接続される。

【００７６】可変抵抗器ＶＲ１の一端は、変成器Ｔ１及びＴ２の一次巻線の他端同士の接続点に接続され、可変抵抗器ＶＲ１の他端は、スイッチＳＷ１の各端のうち、ノイズ発生源ＮＳに接続されていない側の端に接続される。

【００７７】変成器Ｔ１及びＴ２は、ノイズ発生源ＮＳが発生したノイズを被試験機器に注入するためのものである。変成器Ｔ１の一次巻線のホットエンドは被試験機器の電源入力端に接続され、コールドエンドは、上述の通り商用電源の一方の極に接続されている。変成器Ｔ２の一次巻線のホットエンドは被試験機器の電源入力端に接続され、コールドエンドは、上述の通り商用電源の他方の極に接続される。変成器Ｔ１及びＴ２の二次巻線のホットエンド同士は互いに接続されており、またコールドエンド同士も互いに接続されている。

【００７８】変成器Ｔ１の一次巻線と二次巻線の巻数の比は、変成器Ｔ２の一次巻線と二次巻線の巻数の比と実質的に同一であり、また、変成器Ｔ１の一次巻線のインダクタンスは、変成器Ｔ２の一次巻線のインダクタンスと実質的に同一である。このため、可変抵抗器ＶＲ１を介してノイズ発生源ＮＳから供給される電流は、変成器Ｔ１及びＴ２の一次巻線にほぼ等分に分流し、この結果、変成器Ｔ１及びＴ２の二次巻線には、振幅が互いにほぼ等しい起電力が誘起される。そして、この起電力の極性は、変成器Ｔ１及びＴ２のホットエンド同士（及びコールドエンド同士）では同一となる。

【００７９】また、変成器Ｔ１及びＴ２は、各々の二次巻線に、商用電源の両極からノーマルモードの電流が供給されると、各々の二次巻線には、自己誘導により、当該ノーマルモードの電流を打ち消す向きの逆起電力が発生する。一方、変成器Ｔ１及びＴ２の二次巻線に供給されたノーマルモードの電流は、各々の一次巻線に相互誘導による起電力を誘起し、誘起されたこの起電力は、互いの一次巻線に電流を流す結果、互いの二次巻線に、相互誘導により起電力を誘起する。そして、互いの二次巻線に相互誘導により誘起された起電力は、各々の二次巻線に自己誘導により生じた上述の逆起電力を打ち消す向きである。

【００８０】このため、商用電源の両極から、ノーマルモードの電流を供給するために印加されるノーマルモードの電圧は、変成器Ｔ１及びＴ２において実質的に電圧降下を発生させることなく、被試験機器に供給される。そして、変成器Ｔ１及びＴ２の二次巻線は、商用電源の

帯域に属する信号を各々単独に通過させた場合において、その両端に実質的に電圧降下を発生させる程度に大きなリアクタンスを有していてもよい。

【００８１】ノイズ発生源ＮＳが発生する交流電流は、ノイズ発生源ＮＳの発振器の出力端から、スイッチＳＷ１、可変抵抗器ＶＲ１を介して、変成器Ｔ１及びＴ２の一次巻線のホットエンドからコールドエンドを通り、発振器の接地端に流れる。

【００８２】この結果、変成器Ｔ１及びＴ２の二次巻線には、ノイズ発生源ＮＳが発生したノイズの振幅に比例した大きさの起電力が生じる。そしてこの起電力は、被試験機器にノイズを供給する。一方、変成器Ｔ１及びＴ２の二次巻線は、商用電源が供給する電流を実質的な損失を生ずることなく通過させるため、商用電源から供給される電流は、そのまま被試験機器の電源入力端に流れる。

【００８３】従って、被試験機器の各電源入力端には、変成器Ｔ１及びＴ２の二次巻線に生じる電圧と商用電源の電圧の和に実質的に等しい値を有する電圧が印加される。そして、被試験機器の各電源入力端に流れる電流のうち、ノイズの成分は互いに実質的に同相である。すなわち、被試験機器の電源入力端には、コモンモードのノイズが印加される。

【００８４】なお、このノイズ注入器の構成も、上述のものに限られない。例えば、このノイズ注入器は、図８に示すように、変成器Ｔ１の一次巻線のホットエンドを、変成器Ｔ２の一次巻線のホットエンド及びグラウンドのいずれか一方に接続するように切り替え可能なスイッチＳＷ２を備えていてもよい。変成器Ｔ１の１次巻線のホットエンドが接地されるようにスイッチＳＷ２が切り替えられた状態でノイズを発生すると、被試験機器にはノーマルモードノイズが注入される。

【００８５】なお、図８に示すノイズ注入器においても、変成器Ｔ１及びＴ２は、各々の二次巻線に、商用電源の両極からノーマルモードの電流が供給されると、各々の二次巻線には、自己誘導により、当該ノーマルモードの電流を打ち消す向きの逆起電力が発生する。一方、変成器Ｔ１及びＴ２の二次巻線に供給されたノーマルモードの電流は、各々の一次巻線に相互誘導による起電力を誘起し、誘起されたこの起電力は、互いの一次巻線に電流を流す結果、互いの二次巻線に、相互誘導により起電力を誘起する。

【００８６】ただし、変成器Ｔ１の一次巻線のホットエンドが接地されるようにスイッチＳＷ２が切り替えられた状態でノイズが注入される場合、変成器Ｔ１の二次巻線に発生する当該逆起電力は、変成器Ｔ１の一次巻線に相互誘導により誘起される起電力により打ち消されることがない。しかし、この場合においては、変成器Ｔ１の一次巻線の両端は短絡されるので、変成器Ｔ１の二次巻線の両端からみた変成器Ｔ１のリアクタンスは、商用電源の帯域においても、ノイズ発生源ＮＳが発生するノイズの帯域においても、変成器Ｔ１の両端に実質的に電圧降下が生じない程度にまで小さくなる。

【００８７】また、このノイズ注入器は、被試験機器の各電源入力端に、互いに極性が異なるノイズを注入することにより、グラウンドループを介することなく被試験機器にノーマルモードのノイズを注入するようにしてもよい。

【００８８】具体的には、例えば図９に示すように、変成器Ｔ１の一次巻線のホットエンドが可変抵抗器ＶＲ１に接続されコールドエンドが接地される状態と、変成器Ｔ１の一次巻線のコールドエンドが可変抵抗器ＶＲ１に接続されホットエンドが接地される状態とを、ノイズモード切替スイッチにより切り換えられるようにすればよい。

【００８９】ノイズモード切替スイッチを操作して、変成器Ｔ１の一次巻線のホットエンドが可変抵抗器ＶＲ１に接続されコールドエンドが接地される状態としたとき、このノイズ注入器は既に述べた通りの動作を行う。一方、変成器Ｔ１の一次巻線のコールドエンドが可変抵抗器ＶＲ１に接続されホットエンドが接地される状態としたとき、変成器Ｔ１の二次巻線には、変成器Ｔ２の二次巻線に誘起される起電力とは極性が逆の起電力が発生する。すなわち、例えば変成器Ｔ２の二次巻線のホットエンドが正極性となるような向きに起電力が発生しているとき、変成器Ｔ１の二次巻線には、大きさが変成器Ｔ２に誘起されている起電力と実質的に同一で、ホットエンドが負極性となるような向きの起電力が発生する。

【００９０】この結果、被試験機器の各電源入力端には互いに極性が異なるノイズが注入され、従って、被試験機器には、グラウンドループを介することなくノーマルモードのノイズが注入される。

【００９１】なお、図９に示すノイズ注入器においても、変成器Ｔ１及びＴ２は、各々の二次巻線に、商用電源の両極からノーマルモードの電流が供給されると、各々の二次巻線には、自己誘導により、当該ノーマルモードの電流を打ち消す向きの逆起電力が発生する。一方、変成器Ｔ１及びＴ２の二次巻線に供給されたノーマルモードの電流は、各々の一次巻線に相互誘導による起電力を誘起し、誘起されたこの起電力は、互いの一次巻線に電流を流す結果、互いの二次巻線に、相互誘導により起電力を誘起する。そして、被試験機器の各電源入力端に互いに極性が異なるノイズが注入されるようノイズモード切替スイッチが設定されている場合、変成器Ｔ１及びＴ２の各二次巻線に発生する当該逆起電力の向きは、これらの二次巻線に相互誘導により誘起される当該起電力の向きと同一となる。

【００９２】この場合において商用電源の電圧が、実質的に電圧降下を発生させることなく被試験機器に供給されるようにするため、これらの二次巻線は、商用電源の

帯域に属する信号を各々単独に通過させた場合において各両端に実質的に電圧降下が生じない程度に小さなリアクタンスを有するよう設定されている。

【００９３】（第３の実施の形態）第２の実施の形態において、ノイズは変成器を介して被試験機器に注入されていたが、第２の実施の形態においてチョークコイルＬ１及びＬ２が行っている機能を変成器が兼ねていてもよい。これにより、回路の構成は簡略化され、また、商用電源の各極と被試験機器とを結ぶ線路のインピーダンスが、第２の実施の形態に比べて低く抑えられ、電源の供給が効率的に行われる。以下では、ノイズの注入を行う変成器がチョークコイルの機能を行う、この発明の第３の実施の形態のノイズ注入器を説明する。

【００９４】図１０は、このノイズ注入器の構成を示す。図示するように、このノイズ注入器は、変成器Ｔ３と、ノイズ発生源ＮＳと、可変抵抗器ＶＲ１と、スイッチＳＷ１とより構成される。ノイズ発生源ＮＳと、可変抵抗器ＶＲ１と、スイッチＳＷ１は、第１及び第２の実施の形態におけるものと実質的に同一のものである。

【００９５】変成器Ｔ３は、同一のコアにトリファイラに巻かれた３個のコイルからなり、これら３個のコイルのうち１個が一次巻線をなし、他の２個は、互いに別個の二次巻線をなす。変成器Ｔ３の２個の二次巻線の巻数はほぼ等しい。

【００９６】変成器Ｔ３の二次巻線をなす２個のコイルのそれぞれの一方の端は、商用電源の各極に１対１に接続されている。これら２個の二次巻線の、商用電源の各極に接続されている方の端は、いずれもこれらのコイルの巻き始め側の端であるか、又はいずれもこれらのコイルの巻き終わり側の端である。

【００９７】このため、商用電源の両極からノーマルモードの電流が供給されると、変成器Ｔ３の各二次巻線は、各々に流れる電流により各々が自己誘導する逆起電力を打ち消す向きの起電力を、相互誘導により互いに誘起し合う。この結果、一方の二次巻線を流れる電流が相互誘導によって他方の二次巻線に誘起する起電力と、当該他方の二次巻線が自己誘導により発生した逆起電力とが、互いを打ち消し合う。

【００９８】そして、変成器Ｔ３の二次巻線をなすこれら２個のコイルの両端のうち、商用電源の各極に接続されていない方の端は、被試験機器の電源入力端に１対１に接続される。従って、商用電源の両極から、ノーマルモードの電流を供給するために印加されるノーマルモードの電圧は、実質的に電圧降下を発生させることなく、被試験機器に供給される。なお、変成器Ｔ３の各二次巻線は、商用電源の帯域に属する信号を各々単独に通過させた場合において、その両端に実質的に電圧降下を発生させる程度に大きなリアクタンスを有していてもよい。

【００９９】ノイズ発生源ＮＳの各電源入力端は、商用電源の各極に１対１に接続され、出力端は、スイッチＳＷ１の一端に接続され、接地端は、変成器Ｔ３の一次巻線の一端に接続される。可変抵抗器ＶＲ１の一端は、変成器Ｔ３の一次巻線の他端に接続され、可変抵抗器ＶＲ１の他端は、スイッチＳＷ１の各端のうち、ノイズ発生源ＮＳに接続されていない側の端に接続される。

【０１００】ノイズ発生源ＮＳが発生する交流電流は、ノイズ発生源ＮＳの発振器の出力端から、スイッチＳＷ１、可変抵抗器ＶＲ１を介して、変成器Ｔ３の一次巻線を通り、発振器の接地端に流れる。

【０１０１】変成器Ｔ３の一次巻線に電流が供給されると、変成器Ｔ３の各二次巻線には、相互誘導作用による起電力が誘起される。そして、この起電力の極性は、変成器Ｔ３の各二次巻線の巻き始め側の端同士（及び巻き終わり側の端同士）では同一となる。

【０１０２】そして、変成器Ｔ３の各二次巻線の巻数は互いにほぼ等しいため、各二次巻線に誘起される起電力の振幅は互いにほぼ等しいものとなる。従って、変成器Ｔ３の各二次巻線には、ノイズ発生源ＮＳが発生したノイズの振幅に比例した大きさで、且つ互いにほぼ等しい振幅の起電力が生じる。そして、これらの起電力は、商用電源の各極に実質的に電流を流すことなく、ノイズを被試験機器に供給する。

【０１０３】一方、変成器Ｔ３の各二次巻線は、商用電源が供給する電流を実質的な損失を生ずることなく通過させるため、商用電源から供給される電流は、そのまま被試験機器の電源入力端に流れる。

【０１０４】従って、被試験機器の各電源入力端には、変成器Ｔ３の各二次巻線に生じる電圧と商用電源の電圧の和に実質的に等しい値を有する電圧が印加される。そして、被試験機器の各電源入力端に流れる電流のうち、ノイズの成分は互いに実質的に同相である。すなわち、被試験機器の電源入力端には、コモンモードのノイズが印加される。

【０１０５】なお、このノイズ注入器の構成も、上述のものに限られない。例えば、変成器Ｔ３が備える３個の巻線は必ずしもトリファイラに巻かれている必要はない。変成器Ｔ３は、その一次巻線に流れる電流が相互誘導により各二次巻線に誘起する起電力の極性が、商用電源に接続されている方の端同士（あるいは、被試験機器に接続されている端同士）で同一極性になるように、商用電源及び被試験機器に接続することが可能なものであればよい。

【０１０６】また、このノイズ注入器は、被試験機器の各電源入力端に、互いに極性が異なるノイズを注入することにより、グラウンドループを介することなく被試験機器にノーマルモードのノイズを注入するようにしてもよい。従って、このノイズ注入器は、例えば、図１１に示す構成を有していてもよい。

【０１０７】図示するように、図１１のノイズ注入器は、変成器Ｔ３の各二次巻線が、（ａ）そのうち一方の

二次巻線については、当該二次巻線の巻き始めの側の端が商用電源の一方の極に接続され、巻き終わりの側の端が被試験機器の一方の電源入力端に接続されており、

（ｂ）他方の二次巻線については、当該二次巻線の巻き終わりの側の端が商用電源の他方の極に接続され、巻き始めの側の端が被試験機器の他方の電源入力端に接続されている、点を除いて、図１０のノイズ注入器と実質的に同一の構成を有する。

【０１０８】図１１のノイズ注入器においては、ノイズ発生源ＮＳが発生する交流電流が変成器Ｔ３の一次巻線に流れると、変成器Ｔ３の各二次巻線に誘起される１対の誘導電流が、一方は商用電源から被試験機器に向かう方向に流れ、他方は被試験機器から商用電源に向かう方向に流れる。

【０１０９】具体的には、例えば、変成器Ｔ３の各二次巻線に、例えば各々の巻き初めの側の端が正極性となるような向きに起電力が発生しているとした場合、図１１のノイズ注入器は、以下に（１）及び（２）として示す動作を行う。

【０１１０】すなわち、

（１）巻き始めの側の端が被試験機器に接続されている方の二次巻線は、ノイズを構成する電流成分として、自己が発生している起電力に比例した大きさを有し、且つ商用電源から被試験機器へ向かう誘導電流を、自己に流れている電流に重畳する。

（２）一方、巻き始めの側の端が商用電源に接続されている方の二次巻線は、ノイズを構成する電流成分として、他方の二次巻線が（１）の動作で追加した電流成分にほぼ等しい大きさを有し、且つ被試験機器から商用電源へ向かう誘導電流を、自己に流れている電流に重畳する。

【０１１１】この結果、図１１のノイズ注入器は、被試験機器の各電源入力端に互いに極性が異なるノイズを注入する。従って、被試験機器には、グラウンドループを介することなくノーマルモードのノイズが注入される。

【０１１２】更に、このノイズ注入器は、ユーザ等の操作に従って、被試験機器の各電源入力端に、コモンモードのノイズ及びノーマルモードのノイズのうちいずれかを注入するようにしてもよい。具体的には、例えば図１２に示すように、変成器Ｔ３の所定の１個の二次巻線について、以下（ｘ）及び（ｙ）として示す２つの状態を、ノイズモード切替スイッチにより切り換えられるようにすればよい。

【０１１３】すなわち、（ｘ）その巻き始めの側の端が商用電源の所定の極に接続され、巻き終わりの側の端が被試験機器の所定の電源入力端に接続されている状態と、（ｙ）その巻き始めの側の端が、被試験機器の当該所定の電源入力端に接続され、巻き終わりの側の端が商用電源の当該所定の極に接続されている状態と、を、ノイズモード切替スイッチにより切り換えられるようにすればよい。

【０１１４】ユーザ等がノイズモード切替スイッチを操作して、このノイズ注入器を（ｘ）の状態とした場合、図１２のノイズ注入器は、既に述べた図１０のノイズ注入器の動作と実質的に同一の動作を行う。一方、（ｙ）の状態とした場合、図１２のノイズ注入器は、図１１のノイズ注入器の動作と実質的に同一の動作を行う。すなわち、図１２のノイズ注入器は、ユーザ等の操作に従って、被試験機器の各電源入力端に、コモンモードのノイズ及びノーマルモードのノイズのうちいずれかを注入する。

【０１１５】

【発明の効果】以上説明したように、この発明によれば、小型軽量なノイズ注入器が実現され、また、自身で高電圧を発生することなく、安全に電源ラインへのノイズ注入を行うことができるノイズ注入器及びノイズ注入方法が実現される。

【図面の簡単な説明】

【図１】この発明の第１の実施の形態にかかるノイズ注入器の構成を示す回路図である。

【図２】ノイズ発生源の構造を示す回路図である。

【図３】図１に示すノイズ注入器の変形例を示す回路図である。

【図４】図１に示すノイズ注入器の変形例を示す回路図である。

【図５】図１に示すノイズ注入器の変形例を示す回路図である。

【図６】図１に示すノイズ注入器の変形例を示す回路図である。

【図７】この発明の第２の実施の形態にかかるノイズ注入器の構成を示す回路図である。

【図８】図７に示すノイズ注入器の変形例を示す回路図である。

【図９】図７に示すノイズ注入器の変形例を示す回路図である。

【図１０】この発明の第３の実施の形態にかかるノイズ注入器の構成を示す回路図である。

【図１１】図１０に示すノイズ注入器の変形例を示す回路図である。

【図１２】図１０に示すノイズ注入器の変形例を示す回路図である。

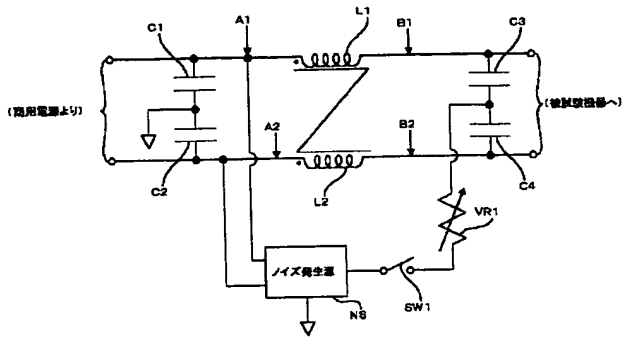
【符号の説明】

ＢＵＦ	バッファ
Ｃ、Ｃ１～Ｃ４	コンデンサ
Ｄ１～Ｄ４	ダイオード
ＩＮＶ	反転増幅器
Ｌ１～Ｌ４	チョークコイル
ＮＳ	ノイズ発生源
ＰＴ、Ｔ、Ｔ１～Ｔ３	変成器
ＳＷ１、ＳＷ２	スイッチ

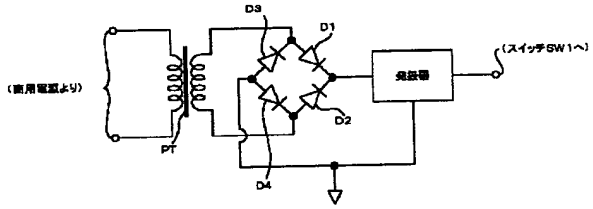
21　　22

VR1、VR2　　可変抵抗器

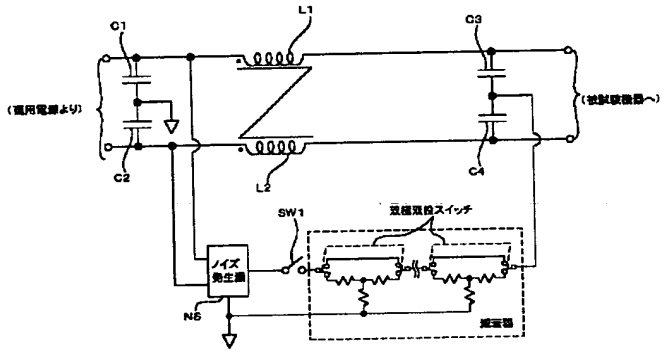
【図１】



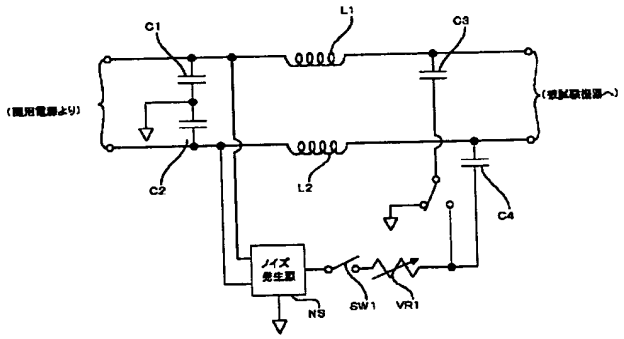
【図２】



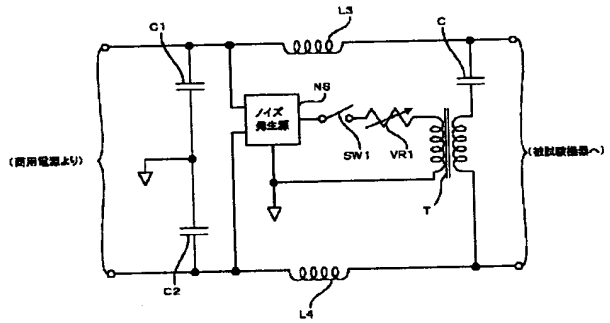
【図３】



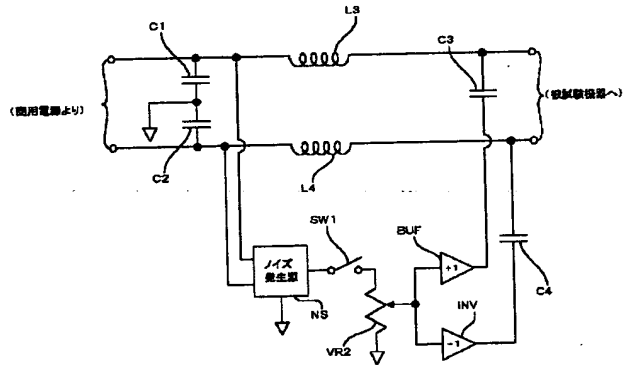
【図４】


C1
L1
C3
C2
L2
C4
ノイズ発生器
NS
SW1
VR1

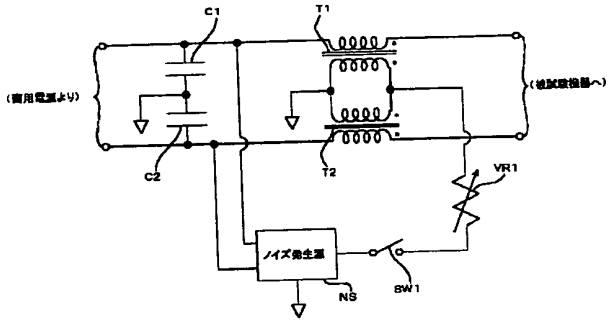
【図５】


C1
L3
C
NS
ノイズ発生器
SW1
VR1
T
C2
L4

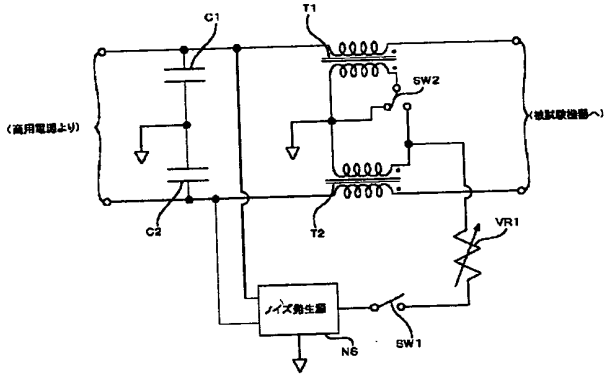
【図６】


C1
L3
C3
C2
L4
SW1
BUF
ノイズ発生器
NS
INV
C4
VR2

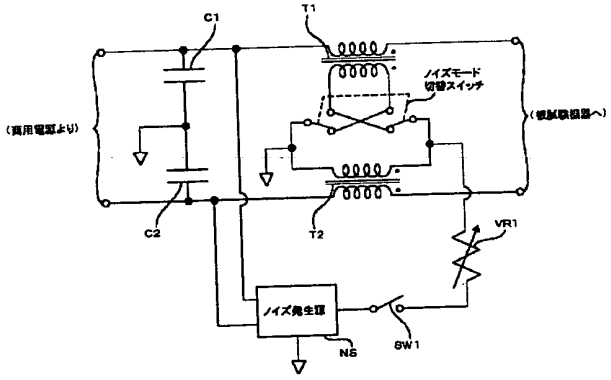
【図７】


C1
T1
(商用電源より)
(被試験機器へ)
C2
T2
VR1
ノイズ発生源
NS
SW1

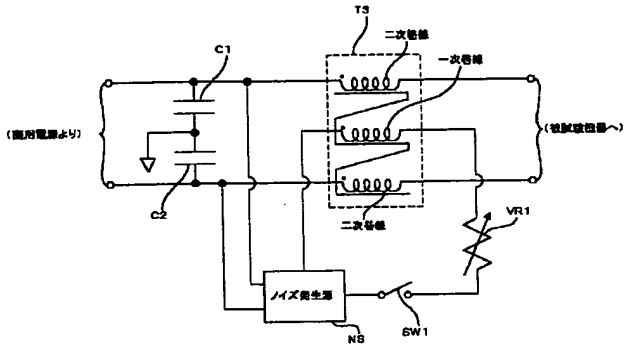
【図８】


C1
T1
SW2
(商用電源より)
(被試験機器へ)
C2
T2
VR1
ノイズ発生源
NS
SW1

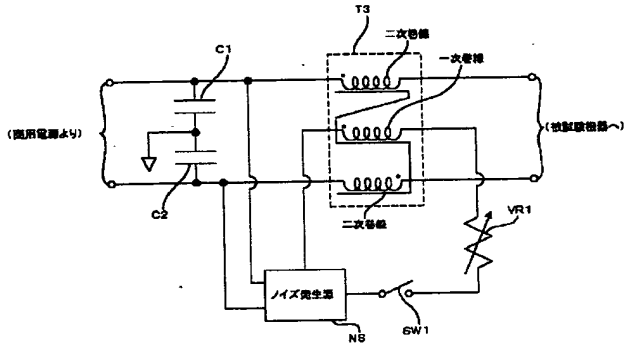
【図９】


C1
T1
ノイズモード
切替スイッチ
(商用電源より)
(被試験機器へ)
C2
T2
VR1
ノイズ発生源
NS
SW1

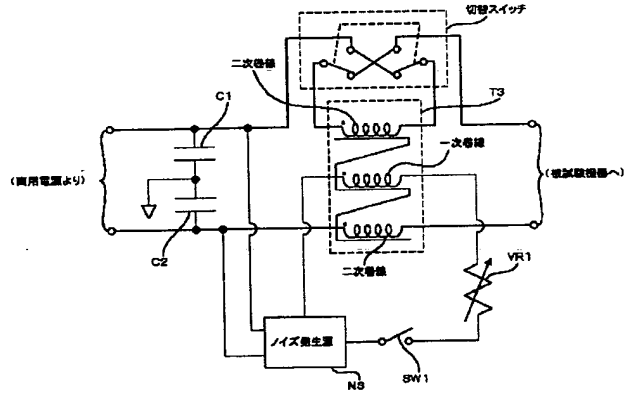
【図１０】


T3
二次巻線
一次巻線
C1
C2
VR1
二次巻線
ノイズ発生源
NS
SW1

【図１１】


T3
二次巻線
一次巻線
C1
C2
VR1
二次巻線
ノイズ発生源
NS
SW1

【図１２】


切替スイッチ
二次巻線
T3
C1
一次巻線
C2
VR1
二次巻線
ノイズ発生源
NS
SW1